ROBOTICS

Product manual

IRB 365

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Workspace 23A version a7
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Product manual

IRB 365-1.5/800
IRB 365-1.5/1100
IRB 365-1.5/1300

OmniCore

Document ID: 3HAC079185-001

Revision: B

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Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

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Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the IRB 365
- maintenance of the IRB 365
- mechanical and electrical repair of the IRB 365

The robot described in this manual has the following protection types:

- *Standard*

Product manual scope

The manual covers all variants and designs of the IRB 365. Some variants and designs may have been removed from the business offer and are no longer available for purchase.

Usage

This manual should be used during:

- installation and commissioning, from lifting the product to its work site and securing it to the foundation, to making it ready for operation
- maintenance work
- repair work
- decommissioning work

> **Note**
>
> It is the responsibility of the integrator to conduct a risk assessment of the final application.
>
> It is the responsibility of the integrator to provide safety and user guides for the robot system.

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

A maintenance/repair/installation craftsman working with an ABB robot must:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.
- be trained to respond to emergencies or abnormal situations.

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References

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Document name	Document ID
Circuit diagram - IRB 365	*3HAC079349-003*
Product specification - IRB 365	*3HAC079184-001*
Product manual - OmniCore C30	*3HAC060860-001*
Safety manual for robot - Manipulator and IRC5 or OmniCore controller [i]	*3HAC031045-001*
Operating manual - OmniCore	*3HAC065036-001*
Application manual - Controller software OmniCore	*3HAC066554-001*
Technical reference manual - System parameters	*3HAC065041-001*

[i] This manual contains all safety instructions from the product manuals for the manipulators and the controllers.

Revisions

Revision	Description
A	First edition.
B	Published in release 23A. The following updates are made in this revision: • Added IRB 365-1.5/800 and IRB 365-1.5/1300. • Added information about *Transportation on page 209*. • Corrected working area for IRB 365 1.5/1100. • Corrected data for *Loads on foundation, robot on page 37*. • Updated article numbers for the signal cables, see *Robot cables on page 67*. • Updated drawings for the hole configuration of the robot base, see *Hole configuration, base on page 51*.

Product documentation

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Product manuals

Manipulators, controllers, DressPack/SpotPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Troubleshooting.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

The technical reference manuals describe reference information for robotics products, for example lubrication, the RAPID language, and system parameters.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, software).
- How to install included or required hardware.
- How to use the application.

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- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and troubleshooters.

How to read the product manual

Reading the procedures

The procedures contain all information required for the installation or service activity and can be printed out separately when needed for a certain service procedure.

Safety information

The manual includes a separate safety chapter that must be read through before proceeding with any service or installation procedures. All procedures also include specific safety information when dangerous steps are to be performed.

Read more in the chapter *Safety on page 15*.

Illustrations

The product is illustrated with general figures that does not take painting or protection type in consideration.

Likewise, certain work methods or general information that is valid for several product models, can be illustrated with illustrations that show a different product model than the one that is described in the current manual.

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1 Safety

1.1 Safety information

1.1.1 Limitation of liability

Limitation of liability

Any information given in this manual regarding safety must not be construed as a warranty by ABB that the industrial robot will not cause injury or damage even if all safety instructions are complied with.

The information does not cover how to design, install and operate a robot system, nor does it cover all peripheral equipment that can influence the safety of the robot system.

In particular, liability cannot be accepted if injury or damage has been caused for any of the following reasons:

- Use of the robot in other ways than intended.
- Incorrect operation or maintenance.
- Operation of the robot when the safety devices are defective, not in their intended location or in any other way not working.
- When instructions for operation and maintenance are not followed.
- Non-authorized design modifications of the robot.
- Repairs on the robot and its spare parts carried out by in-experienced or non-qualified personnel.
- Foreign objects.
- Force majeure.

Spare parts and equipment

ABB supplies original spare parts and equipment which have been tested and approved for their intended use. The installation and/or use of non-original spare parts and equipment can negatively affect the safety, function, performance, and structural properties of the robot. ABB is not liable for damages caused by the use of non-original spare parts and equipment.

1.1.2 Requirements on personnel

General

Only personnel with appropriate training are allowed to install, maintain, service, repair, and use the robot. This includes electrical, mechanical, hydraulics, pneumatics, and other hazards identified in the risk assessment.

Persons who are under the influence of alcohol, drugs or any other intoxicating substances are not allowed to install, maintain, service, repair, or use the robot.

The plant liable must make sure that the personnel is trained on the robot, and on responding to emergency or abnormal situations.

Personal protective equipment

Use personal protective equipment, as stated in the instructions.

1.2 Safety signals and symbols

1.2.1 Safety signals in the manual

Introduction to safety signals

This section specifies all safety signals used in the user manuals. Each signal consists of:

- A caption specifying the hazard level (DANGER, WARNING, or CAUTION) and the type of hazard.
- Instruction about how to reduce the hazard to an acceptable level.
- A brief description of remaining hazards, if not adequately reduced.

Hazard levels

The table below defines the captions specifying the hazard levels used throughout this manual.

Symbol	Designation	Significance
	DANGER	Signal word used to indicate an imminently hazardous situation which, if not avoided, will result in serious injury.
	WARNING	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in serious injury.
	ELECTRICAL SHOCK	Signal word used to indicate a potentially hazardous situation related to electrical hazards which, if not avoided, could result in serious injury.
	CAUTION	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in slight injury.
	ELECTROSTATIC DISCHARGE (ESD)	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in severe damage to the product.
	NOTE	Signal word used to indicate important facts and conditions.

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1.2.1 Safety signals in the manual
Continued

Symbol	Designation	Significance
	TIP	Signal word used to indicate where to find additional information or how to do an operation in an easier way.

1.2.2 Safety symbols on manipulator labels

Introduction to symbols

This section describes safety symbols used on labels (stickers) on the manipulator.

Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.

> **Note**
>
> The symbols on the labels on the product must be observed. Additional symbols added by the integrator must also be observed.

Types of symbols

Both the manipulator and the controller are marked with symbols, containing important information about the product. This is important for all personnel handling the robot, for example during installation, service, or operation.

The safety labels are language independent, they only use graphics. See *Symbols on safety labels on page 19*.

The information labels can contain information in text.

Symbols on safety labels

Symbol	Description
 xx0900000812	**Warning!** Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0900000811	**Caution!** Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0900000839	**Prohibition** Used in combinations with other symbols.

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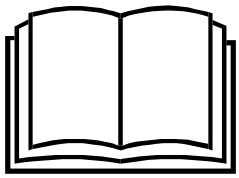
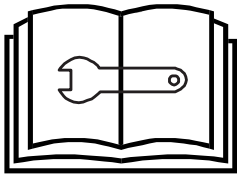
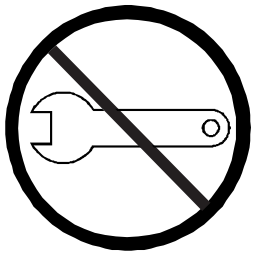
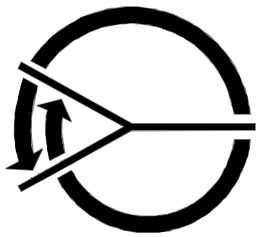
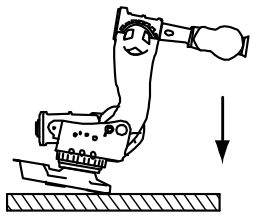
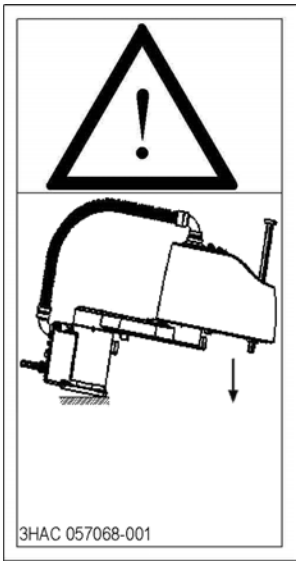
1.2.2 Safety symbols on manipulator labels
Continued

Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*.
 xx0900000816	**Before disassembly, see product manual**
 xx0900000815	**Do not disassemble** Disassembling this part can cause injury.
 xx0900000814	**Extended rotation** This axis has extended rotation (working area) compared to standard.
 xx0900000808	**Brake release** Pressing this button will release the brakes. This means that the robot arm can fall down.

Continues on next page

Symbol	Description
 xx0900000810  xx1500002402	**Tip risk when loosening bolts** The robot can tip over if the bolts are not securely fastened.
  xx0900000817	**Crush** Risk of crush injuries.

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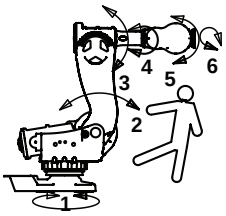
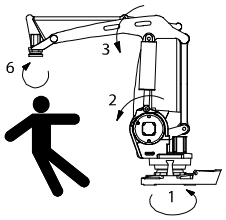
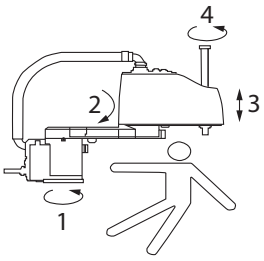
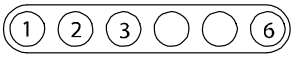
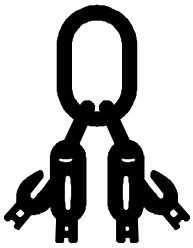
1.2.2 Safety symbols on manipulator labels
Continued

Symbol	Description
 xx0900000818  xx1300001087	**Heat** Risk of heat that can cause burns. (Both signs are used)
 xx0900000819  xx1000001141  xx1500002616	**Moving robot** The robot can move unexpectedly.

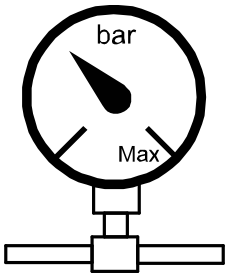
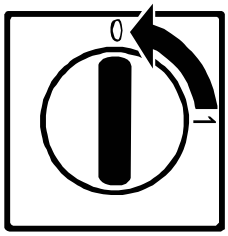
Continues on next page

Symbol	Description
 xx0900000820  xx1000001140	**Brake release buttons**
 xx0900000821	**Lifting bolt**
 xx1000001242	**Chain sling with shortener**
 xx0900000822	**Lifting of robot**
 xx0900000823	**Oil** Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	**Mechanical stop**

Continues on next page

1.2.2 Safety symbols on manipulator labels

Continued

Symbol	Description
 xx1000001144	**No mechanical stop**
 xx0900000825	**Stored energy** Warns that this part contains stored energy. Used in combination with *Do not disassemble* symbol.
 xx0900000826	**Pressure** Warns that this part is pressurized. Usually contains additional text with the pressure level.
 xx0900000827	**Shut off with handle** Use the power switch on the controller.
 xx1400002648	**Do not step** Warns that stepping on these parts can cause damage to the parts.

1.3 Robot stopping functions

Protective stop and emergency stop

The protective stops and emergency stops are described in the product manual for the controller.

For more information see:

- *Product manual - OmniCore C30*

1.4 Safety during installation and commissioning

National or regional regulations

The integrator of the robot system is responsible for the safety of the robot system.

The integrator is responsible that the robot system is designed and installed in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

The integrator of the robot system is required to perform a risk assessment.

Layout

The robot integrated to a robot system shall be designed to allow safe access to all spaces during installation, operation, maintenance, and repair.

If robot movement can be initiated from an external control panel then an emergency stop must also be available.

If the manipulator is delivered with mechanical stops, these can be used for reducing the working space.

A perimeter safeguarding, for example a fence, shall be dimensioned to withstand the following:

- The force of the manipulator.
- The force of the load handled by the robot if dropped or released at maximum speed.
- The maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the robot.

The maximum TCP speed and the maximum velocity of the robot axes are detailed in the section *Robot motion* in the product specification for the respective manipulator.

Consider exposure to hazards, such as slipping, tripping, and falling.

Hazards due to the working position and posture for a person working with or near the robot shall be considered.

Hazards due to noise emission from the robot needs to be considered.

Consider hazards from other equipment in the robot system, for example, that guards remain active until identified hazards are reduced to an acceptable level.

Allergenic material

See *Environmental information on page 210* for specification of allergenic materials in the product, if any.

Securing the robot to the foundation

The robot must be properly fixed to its foundation/support, as described in the respective product manual.

When the robot is installed at a height, hanging, or other than mounted directly on the floor, there will be additional hazards.

Continues on next page

Electrical safety

Incoming mains must be installed to fulfill national regulations.

The power supply wiring to the robot must be sufficiently fused and if necessary, it must be possible to disconnect it manually from the mains power.

The power to the robot must be turned off with the main switch and the mains power disconnected when performing work inside the controller cabinet. Lock and tag shall be considered.

Harnesses between controller and manipulator shall be fixed and protected to avoid tripping and wear.

Wherever possible, power on/off or rebooting the robot controller shall be performed with all persons outside the safeguarded space.

Note

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the robot.

Safety devices

The integrator is responsible for that the safety devices necessary to protect people working with the robot system are designed and installed correctly.

When integrating the robot with external devices to a robot system:

- The integrator of the robot system must ensure that emergency stop functions are interlocked in accordance with applicable standards.
- The integrator of the robot system must ensure that safety functions are interlocked in accordance with applicable standards.

Other hazards

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

The risk assessment should also consider other hazards arising from the application, such as, but not limited to:

- Water
- Compressed air
- Hydraulics

End-effector hazards require particular attention for applications which involve close human collaboration with the robot.

Continues on next page

Pneumatic or hydraulic related hazards

Note

The pressure in the complete pneumatic or hydraulic systems must be released before service and maintenance.

All components in the robot system that remain pressurized after switching off the power to the robot must be marked with clearly visible drain facilities and a warning sign that indicates the hazard of stored energy.

Loss of pressure in the robot system may cause parts or objects to drop.

Dump valves should be used in case of emergency.

Shot bolts should be used to prevent tools, etc., from falling due to gravity.

All pipes, hoses, and connections have to be inspected regularly for leaks and damage. Damage must be repaired immediately.

Verify the safety functions

Before the robot system is put into operation, verify that the safety functions are working as intended and that any remaining hazards identified in the risk assessment are mitigated to an acceptable level.

1.5 Safety during operation

Automatic operation

Verify the application in the operating mode manual reduced speed, before changing mode to automatic and initiating automatic operation.

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

1.6 Safety during maintenance and repair

1.6.1 Safety during maintenance and repair

General

Corrective maintenance must only be carried out by personnel trained on the robot.

Maintenance or repair must be done with all electrical, pneumatic, and hydraulic power switched off, that is, no remaining hazards.

Hazards due to stored mechanical energy in the manipulator for the purpose of counterbalancing axes must be considered before maintenance or repair.

Never use the robot as a ladder, which means, do not climb on the controller, manipulator, including motors, or other parts. There are hazards of slipping and falling. The robot might be damaged.

Make sure that there are no loose screws, turnings, or other unexpected parts remaining after work on the robot has been performed.

When the work is completed, verify that the safety functions are working as intended.

Hot surfaces

Surfaces can be hot after running the robot, and touching these may result in burns. Allow the surfaces to cool down before maintenance or repair.

Allergic reaction

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.

Gearbox lubricants (oil or grease)

When handling oil, grease, or other chemical substances the safety information of the respective manufacturer must be observed.

Note

Take special care when handling hot lubricants.

Warning	Description	Elimination/Action
 **Hot oil or grease**	Changing and draining gearbox oil or grease may require handling hot lubricant heated up to 90 °C.	Make sure that protective gear like goggles and gloves are always worn during this activity.

Continues on next page

Warning	Description	Elimination/Action
 **Allergic reaction**	When working with lubricants there is a risk of an allergic reaction.	Make sure that protective gear like goggles and gloves are always worn.
 **Possible pressure build-up in gearbox**	When opening the oil or grease plug, there may be pressure present in the gearbox, causing lubricant to spray from the opening.	Open the plug carefully and keep away from the opening. Do not overfill the gearbox when filling.
 **Do not overfill**	Overfilling of gearbox lubricant can lead to internal over-pressure inside the gearbox which in turn may: • damage seals and gaskets • completely press out seals and gaskets • prevent the robot from moving freely.	Make sure not to overfill the gearbox when filling it with oil or grease. After filling, verify that the level is correct.
 **Specified amount depends on drained volume**	The specified amount of oil or grease is based on the total volume of the gearbox. When changing the lubricant, the amount refilled may differ from the specified amount, depending on how much has previously been drained from the gearbox.	After filling, verify that the level is correct.

Hazards related to batteries

Under rated conditions, the electrode materials and liquid electrolyte in the batteries are sealed and not exposed to the outside.

There is a hazard in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. As a result under certain circumstances, electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow.

Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.

Operating temperatures are listed in *Operating conditions, robot on page 39*.

See safety instructions for the batteries in *Material/product safety data sheet - Battery pack* (*3HAC043118-001*).

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

Continues on next page

1.6.1 Safety during maintenance and repair
Continued

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

Related information

See also the safety information related to installation and operation.

1.6.2 Emergency release of the robot axes

Description

In an emergency situation, the brakes on a robot axis can be released manually by pushing a brake release button.

How to release the brakes is described in the section:

- *Manually releasing the brakes on page 61*.

The robot may be moved manually on smaller robot models, but larger models may require using an overhead crane or similar equipment.

Increased injury

Before releasing the brakes, make sure that the weight of the manipulator does not result in additional hazards, for example, even more severe injuries on a trapped person.

DANGER

When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways.

Make sure no personnel is near or beneath the robot.

1.6.3 Brake testing

When to test

During operation, the holding brake of each axis normally wears down. A test can be performed to determine whether the brake can still perform its function.

How to test

The function of the holding brake of each axis motor may be verified as described below:

1. Run each axis to a position where the combined weight of the manipulator and any load is maximized (maximum static load).
2. Switch the motor to the MOTORS OFF.
3. Inspect and verify that the axis maintains its position.

   If the manipulator does not change position as the motors are switched off, then the brake function is adequate.

Note

It is recommended to run the service routine *BrakeCheck* as part of the regular maintenance, see the operating manual for the robot controller.

For robots with the option SafeMove, the *Cyclic Brake Check* routine is recommended. See the manual for SafeMove in *References on page 10*.

1.7 Safety during troubleshooting

General

When troubleshooting requires work with power switched on, special considerations must be taken:

- Safety circuits might be muted or disconnected.
- Electrical parts must be considered as *live*.
- The manipulator can move unexpectedly at any time.

DANGER

Troubleshooting on the controller while powered on must be performed by personnel trained by ABB or by ABB field engineers.

A risk assessment must be done to address both robot and robot system specific hazards.

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

Related information

See also the safety information related to installation, operation, maintenance, and repair.

1.8 Safety during decommissioning

General

See section *Decommissioning on page 209*.

If the robot is decommissioned for storage, take extra precaution to reset safety devices to delivery status.

Unexpected movement of robot arm

WARNING

Hazards due to the use of brake release devices and/or gravity beneath the manipulator shall be considered.

A robot may perform unexpected limited movement.

WARNING

Manipulator movements can cause serious injuries on users and may damage equipment.

2 Technical data

2.1 Technical data

Weight, robot

The table shows the weight of the robot.

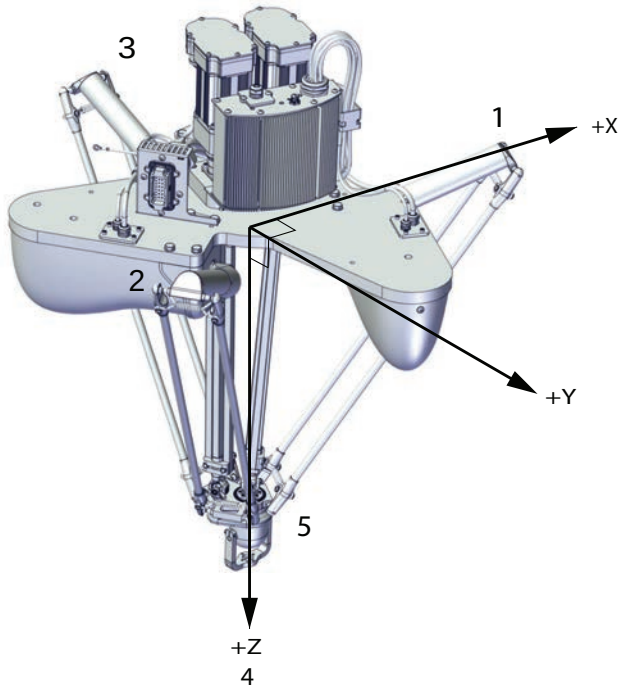
Robot model	Nominal weight
IRB 365-1.5/800	86 kg
IRB 365 1.5/1100	86 kg
IRB 365-1.5/1300	86 kg

Note

The weight does not include additional options, tools and other equipment fitted on the robot.

The weight does not include the weight of the DressPack.

Loads on foundation, robot



xx2200000421

The table shows the various forces and torques working on the robot during different kinds of operation.

Note

These forces and torques are extreme values that are rarely encountered during operation. The values also never reach their maximum at the same time!

Continues on next page

WARNING

The robot installation is restricted to the mounting options given in following load table(s).

Suspended in robot frame

Force	Endurance load (in operation)	Maximum load (emergency stop)
Force xy	±0.32 kN	±2.3 kN
Force z	0.97 ± 0.21 kN	1.5 ± 0.78 kN
Torque xy	0.21 kNm	1.56 kNm
Torque z	0.10 kNm	0.51 kNm

Requirements, foundation

The table shows the requirements for the foundation where the weight of the installed robot is included:

Requirement	Value	Note
Flatness of foundation surface	0.3 mm	Flat foundations give better repeatability of the resolver calibration compared to original settings on delivery from ABB. The value for levelness aims at the circumstance of the anchoring points in the robot base.
Maximum tilt	0°	
Minimum resonance frequency	35 Hz **Note** It may affect the manipulator lifetime to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment. [i] For information about compensating for foundation flexibility, see *Application manual - Controller software OmniCore*, section *Motion Process Mode*.

i The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possibly to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25°C
Maximum ambient temperature	60°C
Maximum ambient temperature (less than 24 hrs)	90°C

Continues on next page

Parameter	Value
Maximum ambient humidity	90% at constant temperature

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	0°C [i]
Maximum ambient temperature	45°C
Maximum ambient humidity	90% at constant temperature

[i] At low environmental temperature < 10°C is, as with any other machine, a warm-up phase recommended to be run with the robot. Below 5°C this warm-up phase is mandatory. Otherwise there is a risk that the robot stops or run with lower performance due to temperature dependent oil- and grease viscosity.

Protection classes, robot

The table shows the available protection types of the robot, with the corresponding protection class.

Protection type	Protection class [i]
Manipulator, protection type Standard	IP54

[i] According to IEC 60529.

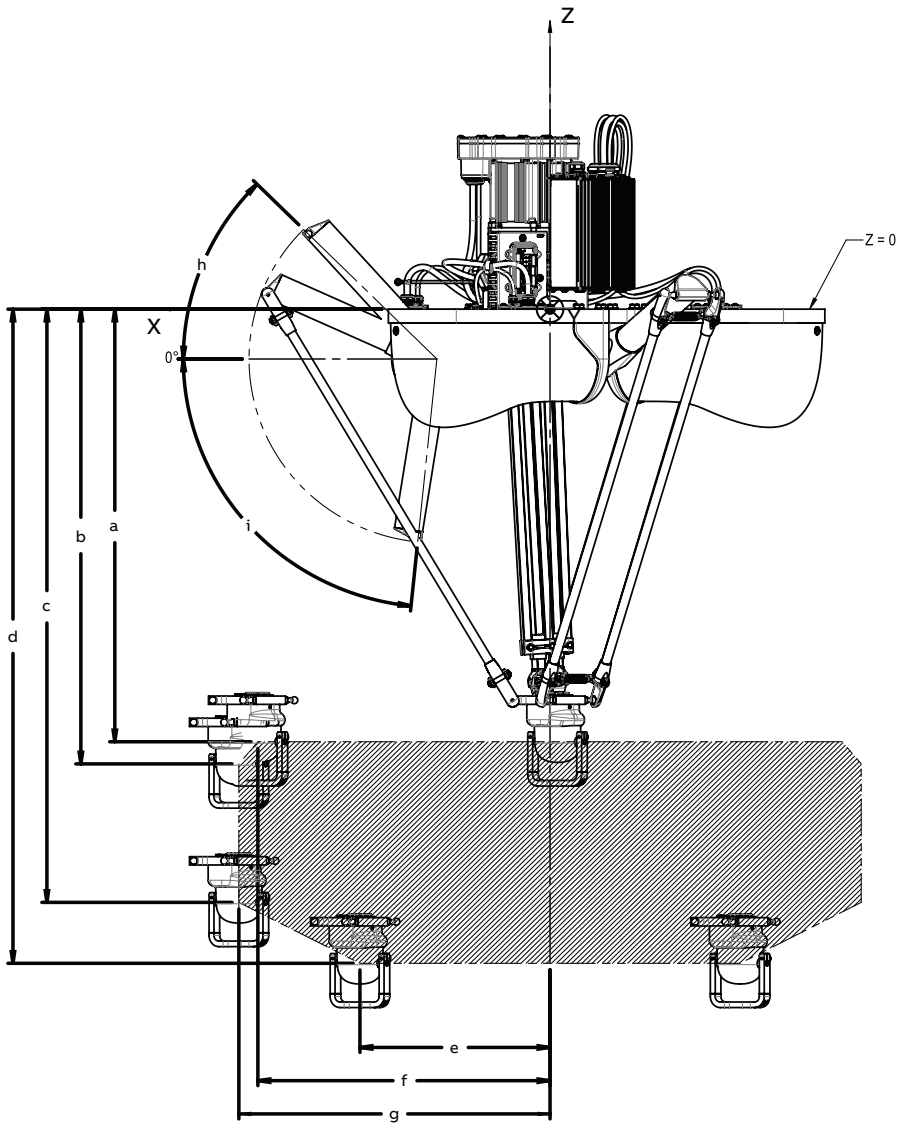
Environmental information

The product complies with IEC 63000. *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*.

2.2 Working range

Illustration, working range

This illustration shows the unrestricted working range of the robot.



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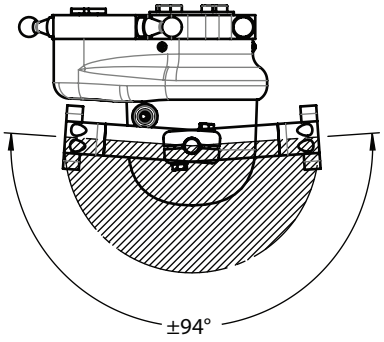
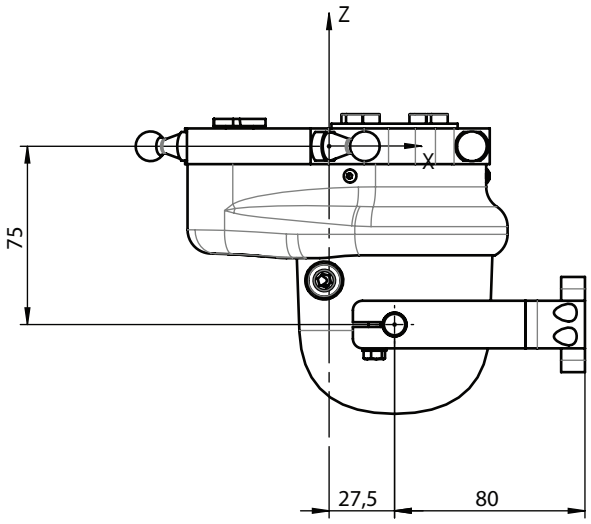
Dimensions

Variant	a	b	c	d	e	f	g	h	i
IRB 365-1.5/800	731	731	981	1081	257	400	400	-35°	+88°
IRB 365 1.5/1100	781	821	1031	1181	335	516	550	-47°	+99.5°
IRB 365-1.5/1300	881	931	1131	1281	409	608	650	-34°	+93.5°

Continues on next page



Axis 5



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2.3 The unit is sensitive to ESD

Description

ESD (electrostatic discharge) is the transfer of electrical static charge between two bodies at different potentials, either through direct contact or through an induced electrical field. When handling parts or their containers, personnel not grounded may potentially transfer high static charges. This discharge may destroy sensitive electronics.

Safe handling

Use one of the following alternatives:

- Use a wrist strap.

  Wrist straps must be tested frequently to ensure that they are not damaged and are operating correctly.
- Use an ESD protective floor mat.

  The mat must be grounded through a current-limiting resistor.
- Use a dissipative table mat.

  The mat should provide a controlled discharge of static voltages and must be grounded.

3 Installation and commissioning

3.1 Introduction to installation and commissioning

General

This chapter contains assembly instructions and information for installing the IRB 365 at the working site.

See also the product manual for the robot controller.

The installation must be done by qualified installation personnel in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

Safety information

Before any installation work is commenced, all safety information must be observed.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 15* before performing any installation work.

Note

Always connect the IRB 365 and the robot to protective earth and residual current device (RCD) before connecting to power and starting any installation work.

For more information see:

- *Product manual - OmniCore C30*

3.2 Unpacking

3.2.1 Pre-installation procedure

Introduction

This section is intended for use when unpacking and installing the robot for the first time. It also contains information useful during later re-installation of the robot.

Prerequisites for installation personnel

Installation personnel working with an ABB product must:

- Be trained by ABB and have the required knowledge of mechanical and electrical installation/maintenance/repair work.
- Conform to all national and local codes.

Checking the pre-requisites for installation

	Action
1	Make a visual inspection of the packaging and make sure that nothing is damaged.
2	Remove the packaging.
3	Check for any visible transport damage.  **Note** Stop unpacking and contact ABB if transport damages are found.
4	Clean the unit with a lint-free cloth, if necessary.
5	Make sure that the lifting accessory used (if required) is suitable to handle the weight of the robot as specified in: *Weight, robot on page 37*
6	If the robot is not installed directly, it must be stored as described in: *Storage conditions, robot on page 38*
7	Make sure that the expected operating environment of the robot conforms to the specifications as described in: *Operating conditions, robot on page 39*
8	Before taking the robot to its installation site, make sure that the site conforms to: • *Loads on foundation, robot on page 37* • *Protection classes, robot on page 39* • *Requirements, foundation on page 38*
9	When these prerequisites are met, the robot can be taken to its installation site as described in section: *On-site installation on page 45*
10	Install required equipment, if any.

3.3 On-site installation

3.3.1 Brief installation procedure

Introduction

This procedure is a brief guide when installing the robot for the first time. Also see *Pre-installation procedure on page 44*.

First installation

Use these procedures to install the IRB 365.

	Action	Note
1	Transport the manipulator to its intended location. **Note** Make sure to have required free space above the manipulator to be able to access the parts inside during maintenance or repair. See *Minimum required free space above the robot on page 46*.	
2	Install the valid platform or prepare the foundation for the manipulator.	
3	Lift and secure the manipulator to the platform/foundation.	See *Orienting, assembling and securing the manipulator on page 49*.
4	Connect the manipulator to the controller.	See • *Product manual - OmniCore C30*
5	Configure the safety settings.	See • *Product manual - OmniCore C30*
6	How to start and run the robot is described in the product manual for the controller.	See • *Product manual - OmniCore C30*
7	Install required equipment, if any.	
8	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

3.3.2 Minimum required free space above the robot

Service activities require free space above the robot

Consider the need of sufficient free space above the robot, before installation.

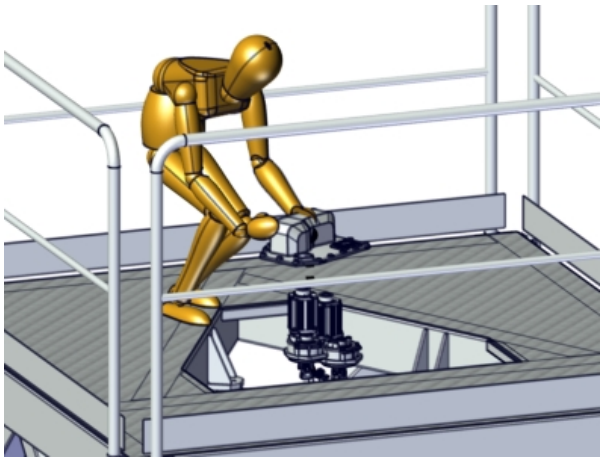
Following service activities require free space:

- Lifting away the base top cover.
- Replacing the base components, such as the SMB battery, axis-4 and axis-5 motor, cable harness.

Examples of access ways to the base components

Service platform

A service platform for access from above is recommended.



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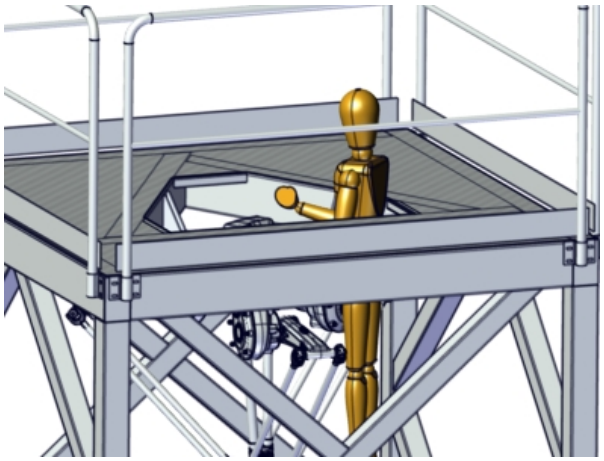
Access way beside the robot

If a platform is not possible the service personnel need to be able to stand beside the robot according to the figure.



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3.3.3 Securing the robot frame

General

This section specifies the requirements for the robot frame installation.

Requirements on robot frame fastening

The fastening of the robot frame to the foundation must withstand the operational loads. See *Loads on foundation, robot on page 37*.

The requirements for the robot foundation, that is the robot anchoring points on the robot frame, must be met. See *Requirements, foundation on page 38*.

WARNING

The robot frame must be secured before mounting the robot.

Required equipment

Equipment	Spare part no.	Note
Standard tools		*Standard toolkit on page 220*

Orienting and securing

	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section *Technical data on page 37*.	
2	Make sure that the space above the installation site is sufficient for repair and maintenance.	See *Minimum required free space above the robot on page 46*.
3	Prepare the installation site.	
4	Secure the robot frame to the floor. **Note** Use leveling shims if needed.	Use fastening bolts that withstand the requirements for current foundation.
5	Make sure the robot anchoring points are level after having installed and secured the frame to the floor/foundation.	See *Requirements, foundation on page 38*. See *Illustration of leveling the robot frame on page 48*.

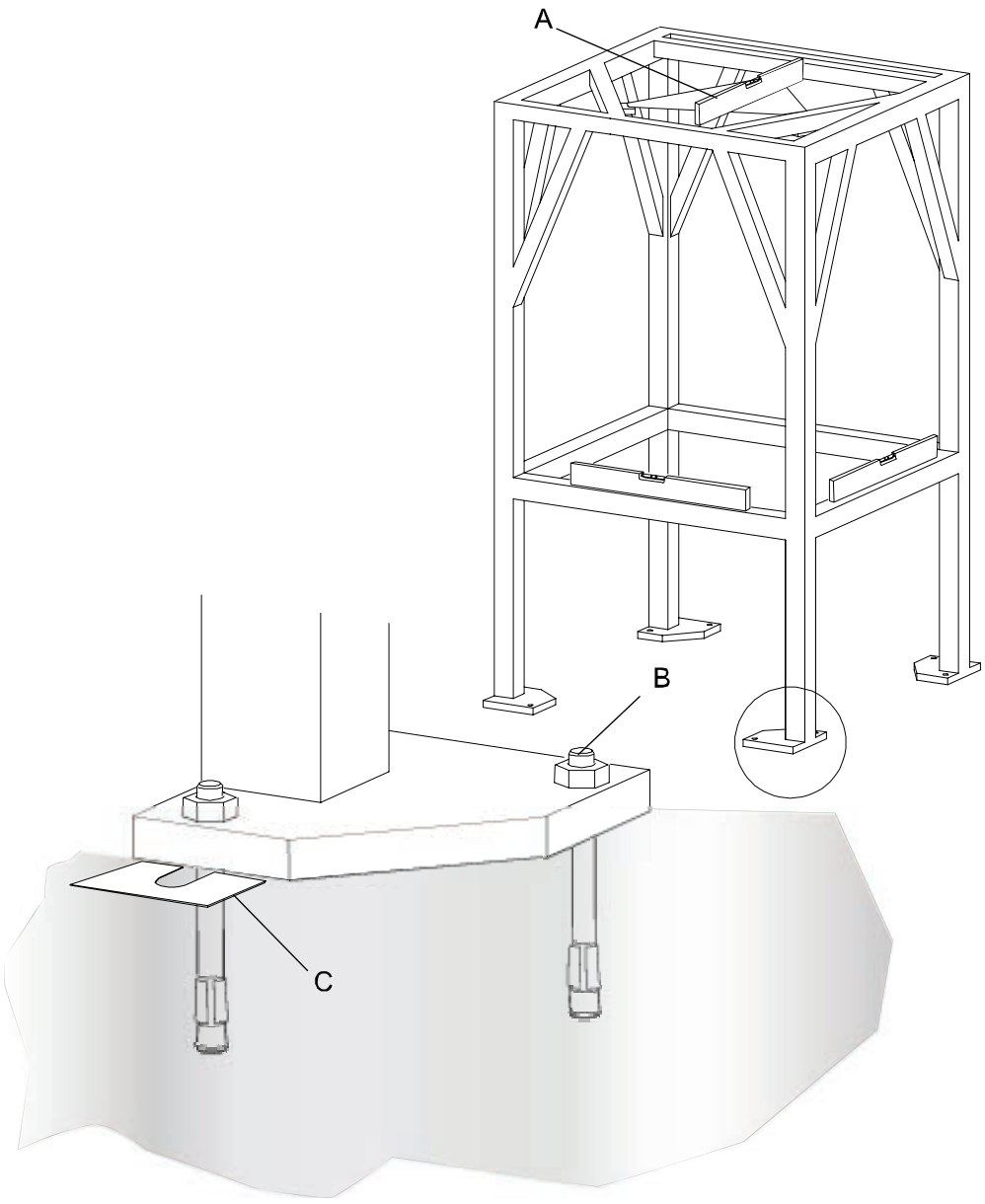
Continues on next page

3.3.3 Securing the robot frame
Continued

Illustration of leveling the robot frame

The illustration is an example of how to meet the requirements for robot foundation, when fastening the robot frame.

The robot anchoring points in the frame must achieve required values for the foundation requirements to run the robot safely. See *Requirements, foundation on page 38*.



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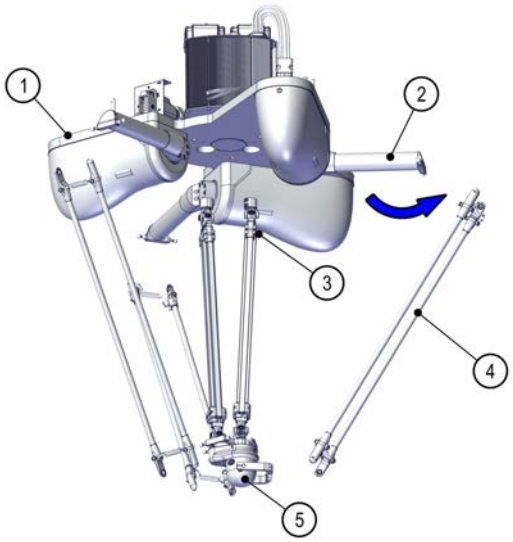
A	Spirit level
B	Fastening bolts that withstand requirements for current foundation
C	Shim

3.3.4 Orienting, assembling and securing the manipulator

Overview of the assembly order

The IRB 365 is delivered in sub-assemblies which are assembled in the following order:

	Assembly order	Illustration
1	Install the base unit.	 xx2100000836
2	Move the upper arms into calibration position (horizontal).	
3	Attach the upper end of the telescopic shafts to the motor axes (axes 4 and 5).	
4	Attach the lower arms to the upper arms.	
5	Attach the lower arms to the delta unit.	
6	**Note** Make sure not to over-extend the length of the telescope shafts due to risk of damaging the slide bearing.	

Detailed procedures for each step are given further on in this section.

Attachment screws

The table below specifies the type of securing screws and washers to be used for securing the robot to the base foundation.

Suitable screws	M16. Minimum length of thread engagement: 25 mm
Quantity	3 pcs
Quality	Screw class 8.8 with Yield Strength 640 MPa
Suitable washer	17x25x3 coated stainless steel HV200 (3HAC060866-005)
Tightening torque	200 Nm

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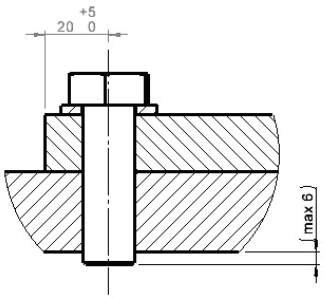
3.3.4 Orienting, assembling and securing the manipulator
Continued

Level surface requirements	0.3 mm
Loctite on threads	5700



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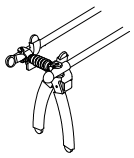
Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

Required service parts

Consumable	Article number	Note
Cleaning agent	-	Isopropanol

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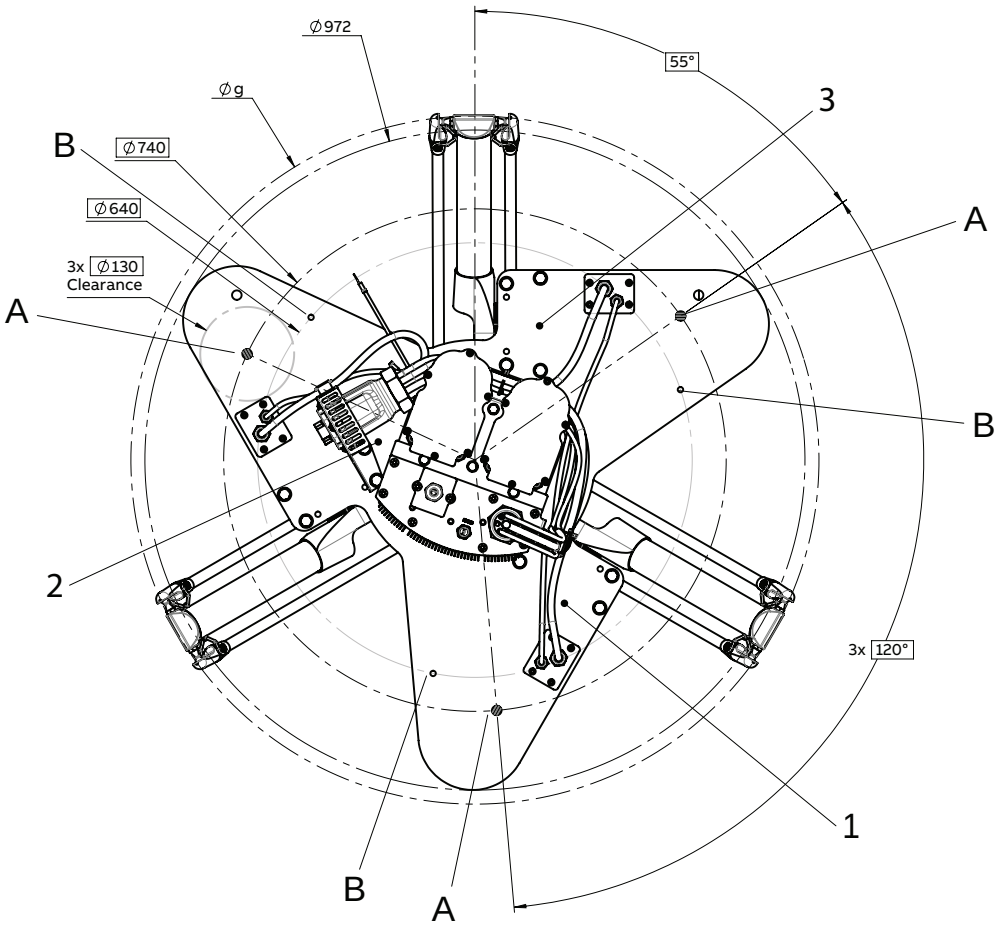
Hole configuration, base

This illustration shows the hole configuration used when securing the robot.



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1	Axis-1 gearbox
2	Axis-2 gearbox
3	Axis-3 gearbox
A	Robot mounting holes There is a clearance of Ø130 mm around the holes.
B	Attachment holes M8 for lifting eyes
g	IRB 365-1.5/800: 1,100 mm
g	IRB 365 1.5/1100: 1,100 mm
g	IRB 365-1.5/1300: 1,300 mm

The three support points of the manipulator base box shall be mounted against three flat surfaces with a flatness within the specification. Use shims if necessary.

See specification in *Requirements, foundation on page 38*.

See also *Fitting equipment on the robot (robot dimensions) on page 64*.

Continues on next page

3.3.4 Orienting, assembling and securing the manipulator
Continued

Assembling and installing

The IRB 365 is delivered in sub-assemblies.

Assemble the manipulator according to the following order.

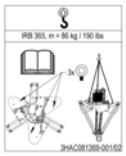
Preparations of the installation site

Use the procedure to prepare the installation site.

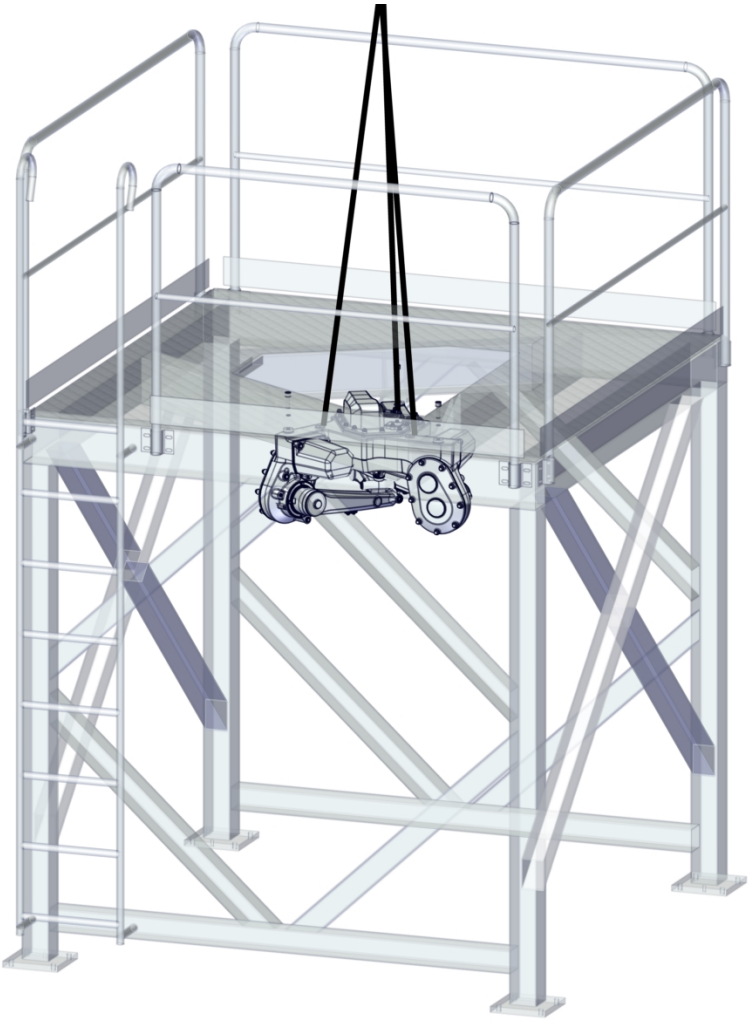
	Action	Note
1	Make sure the installation site for the robot conforms to the specifications in section *Technical data on page 37*.	
2	Make sure that the space above the installation site is sufficient for repair and maintenance.	See *Minimum required free space above the robot on page 46*.
3	Prepare the installation site with attachment holes.	The hole configuration of the base is shown in the figure in *Hole configuration, base on page 51*.

Installing the base unit

Use the procedure to install the base unit.

	Action	Note
1	Fasten three lifting eyes M8.	 xx2200000600
2	**CAUTION** The weight of the complete base unit and upper arms is 86 kg. All lifting accessories used must be sized accordingly.	
3	Attach the round slings to the lifting eyes. **Note** Make sure the round slings do not rub against any sharp edges.	Make sure the round sling has free space and does not wear against any part of the robot.
4	**WARNING** Personnel must not, under any circumstances, be present under the suspended load.	

Continues on next page

	Action	Note
5	Lift the base unit to its mounting position, mate to the attachment holes and secure with attachment bolts and washers. Attachment bolts: M16. Minimum length of thread engagement: 25 mm, Screw class 8.8 with Yield Strength 640 MPa (3 pcs) Washers: 17x25x3 coated stainless steel **Note** Do not damage the robot cabling.  xx2000000470	

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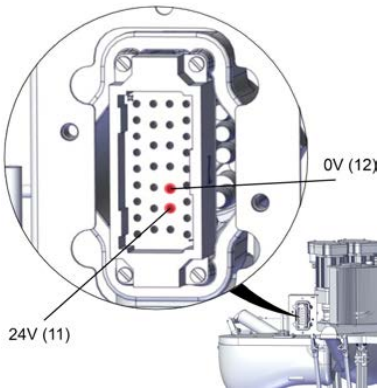
3.3.4 Orienting, assembling and securing the manipulator
Continued

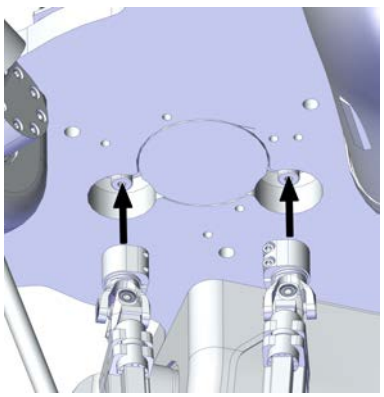
Moving the upper arms to installation position

Use this procedure to release the brakes and move the upper arms into installation position.

	Action	Note
1	Supply power to connector R1.MP on the robot, to be able to use the brake release button: • 0V on pin 12. • 24V on pin 11. **DANGER** Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously and instantly! **Note** Do not interchange the 24V and 0V pins. If they are mixed up, damage can be caused to internal electrical components.	 xx2100000785
2	Release the brakes by pressing the brake release button and move the upper arms to calibration position.	*Releasing the brakes on page 61*  xx2200000021
3	Disconnect the 24V supply from the R1.MP connector.	

Attaching the telescopic shaft assembly and lower arms

Use this procedure to fit the telescopic shaft assembly.

	Action	Note
1	Refit the telescopic shaft assembly including delta unit. **Note** Do not tighten the mounting clamps screws before refitting the lower arms.	 xx2100000759

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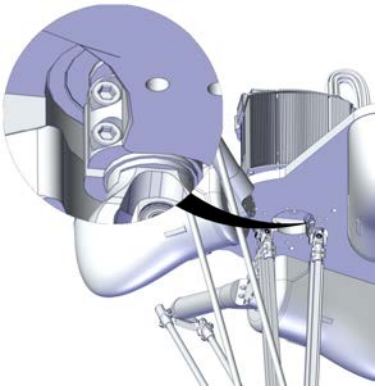
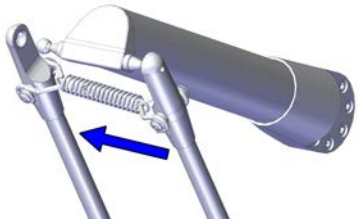
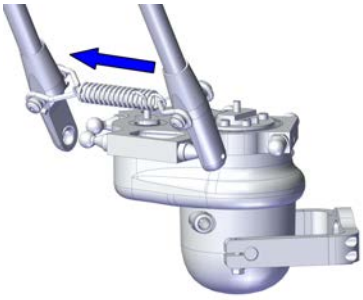
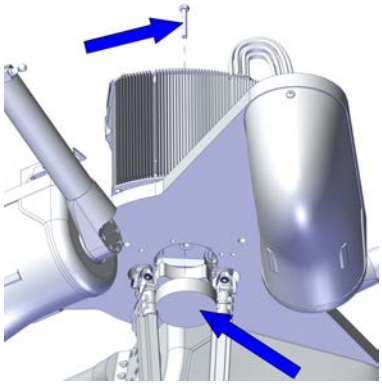
	Action	Note
2	Tighten mounting clamping screws.	Tightening torque: 10 Nm  xx2100000729
3	Fit the lower arms to the upper arms by using the pliers, either on the left side or the right side, not both. **Note** Be careful not to damage the ball bearing cups	 xx2100000721
4	Fit the lower arms to the delta unit by using the pliers, either on the left side or the right side, not both. **Note** Be careful not to damage the ball bearing cups	 xx2100000722
5	Fit the center base cover.	 xx2100000732

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3.3.4 Orienting, assembling and securing the manipulator
Continued

Calibration

	Action	Note
1	Update the revolution counters.	See *Updating revolution counters on OmniCore robots on page 202*.

3.3.5 Loads fitted to the robot, stopping time and braking distances

Define loads carefully

Any loads mounted on the robot must be defined correctly and carefully (with regard to the position of center of gravity and mass moments of inertia) in order to avoid jolting movements and overloading motors, gears and structure.

CAUTION

Incorrectly defined loads may result in operational stops or major damage to the robot.

Load diagrams, permitted extra loads (equipment) and their positions are specified in the product specification. The loads must be defined in the software.

Stopping time and braking distances

The performance of the motor brake depends on if there are any loads attached to the robot.

See *Product specification - Robot stopping distances according to ISO 10218-1*.

3.3.6 Brake release unit

General

The robot cable harness has a brake release unit connected to the SMB battery compartment.

Brake release box installation

The figure shows a routed cable from the brake release unit to the SMB battery compartment located on top of the base unit.

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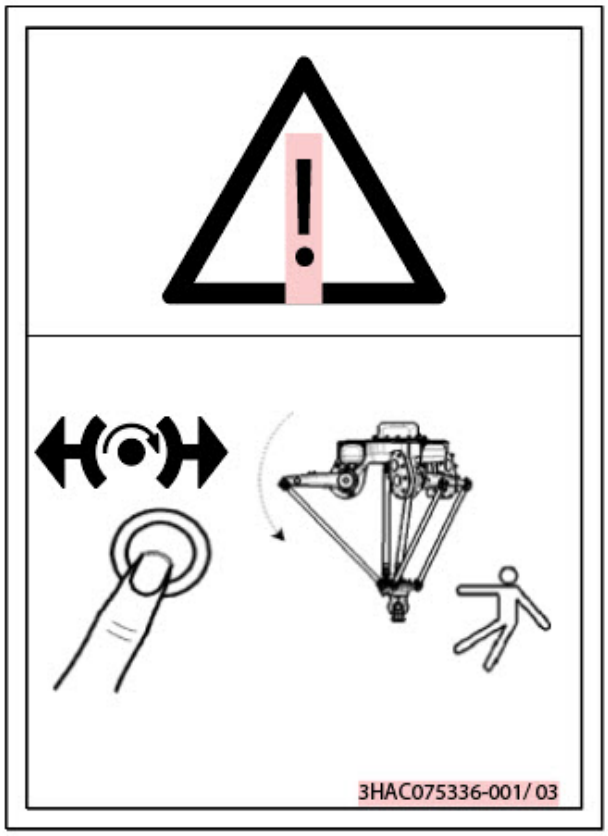
The figure shows an instruction label to be mounted next to the brake release unit.



xx2200000601

CAUTION

Risk of unintended contact with the push button. Place the brake release box in a way that eliminates the risk of unintended contact with the push button.

Note

The equipment must be installed in accordance with the specified protection class, see *Protection classes, robot on page 39*.

Note

Place the equipment in a manner that makes it obvious which manipulator it is connected to. There must be no doubt on which manipulator is affected when activating the button.

Continues on next page

3.3.6 Brake release unit
Continued

Technical specification

Function	Data
Signal	24V DC
Current	13A continuously

3.3.7 Manually releasing the brakes

Introduction to manually releasing the brakes

This section describes how to release the holding brakes for the axes motors.

Location of the brake release unit

The brake release unit is located as shown in the figure.

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Releasing the brakes

This procedure describes how to release the holding brakes when the robot is equipped with a brake release unit.

	Action	Note
1	**Note** If the robot is not connected to the controller, power must be supplied to the connector R1.MP according to the section *Supplying power to connector R1.MP on page 62*.	
2	**DANGER** When releasing the holding brakes, the robot axes may move very quickly and sometimes in unexpected ways. Make sure no personnel is near or beneath the robot.	

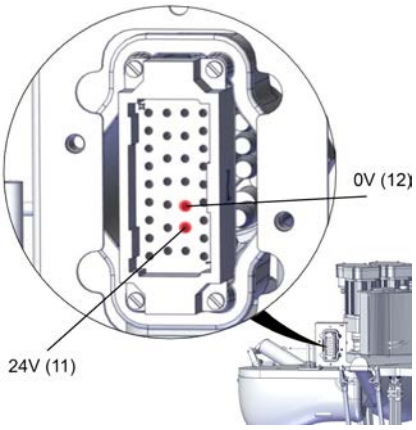
Continues on next page

3.3.7 Manually releasing the brakes
Continued

	Action	Note
3	Release the holding brake of all axes by pressing the brake release button. The brake will be enable as soon as the button is released. **WARNING** Pressing the brake release button will release the holding brakes on all axes simultaneously.	 xx2100002498

Supplying power to connector R1.MP

If the robot is not connected to the controller, power must be supplied to connector R1.MP on the robot, in order to enable the brake release buttons.

	Action	Note
1	**DANGER** Incorrect connections, such as supplying power to the wrong pin, may cause all brakes to be released simultaneously and instantly!	
2	Supply • 0V on pin 12. • 24V on pin 11. **Note** Do not interchange the 24V and 0V pins. If they are mixed up, damage can be caused to internal electrical components.	 xx2100000785
3	Use the brake releasing button as described in *Releasing the brakes on page 61*.	

3.3.8 Start of robot in cold environments

Introduction

This section describes how to start the robot in a cold environment if it is not starting the normal way.

Problems with starting the robot

Event message from Motion Supervision

Use this procedure if an event message indicates a problem with Motion supervision at start-up. More information about Motion Supervision is found in *Technical reference manual - System parameters*.

	Action	Note
1	Turn off Motion Supervision.	
2	Start the robot.	
3	When the robot has reached normal working temperature, the Motion Supervision can be turned on again.	

Robot stopping with other event message

Use this procedure if the robot is not starting.

	Action	Note
1	Start the robot with its normal program but with reduced speed.	The speed can be regulated with the RAPID instruction `VelSet`.

Adjusting the speed and acceleration during warm-up

Depending on how cold the environment is and what program is being used, the speed might need to be ramped up until reached maximum. The table shows examples of how to adjust the speed:

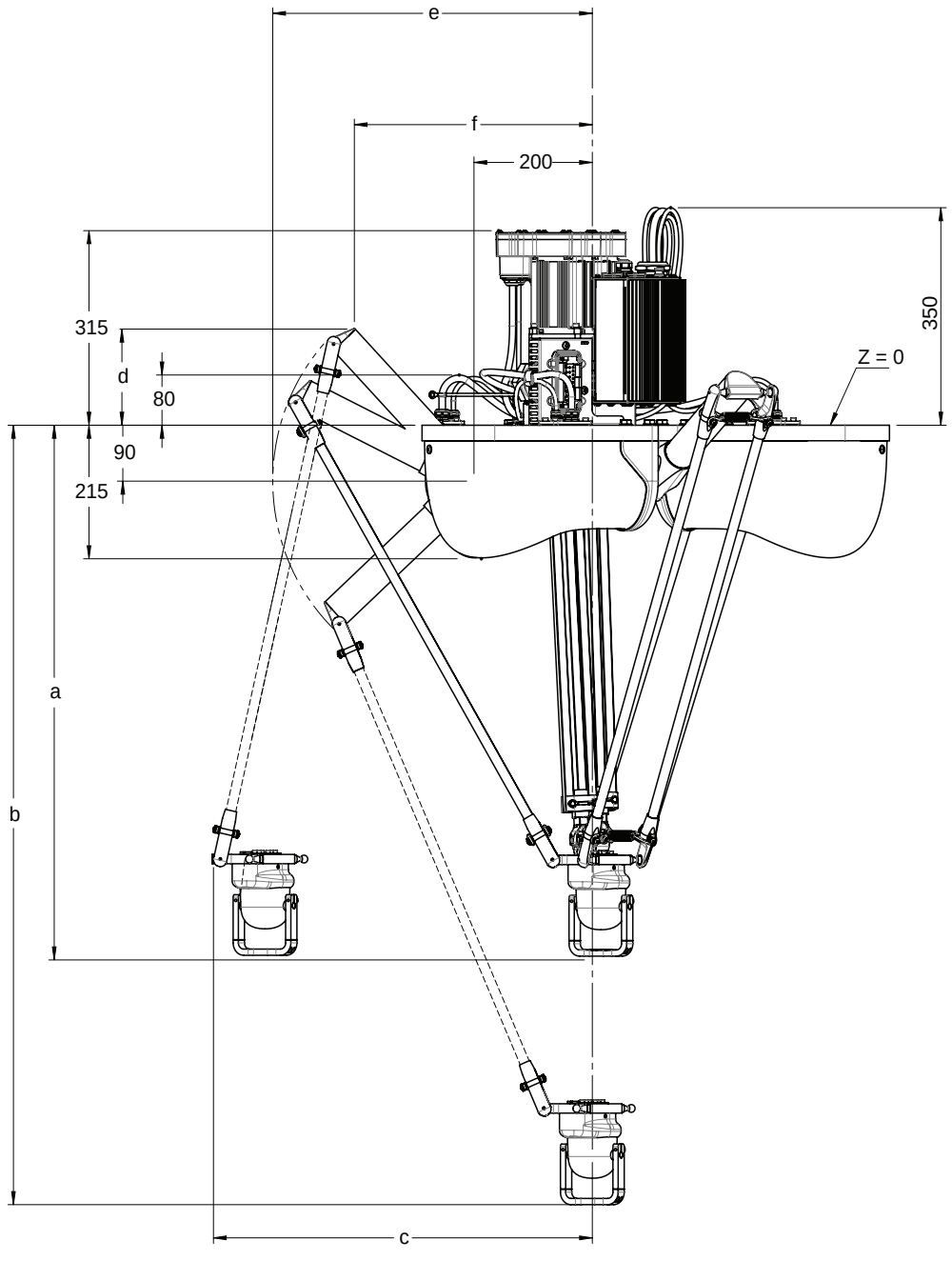
Work cycles	`AccSet`	Speed/velocity
3 Work cycles	20, 20	v100 (100 mm/s)
5 Work cycles	40, 40	v400 (400 mm/s)
5 Work cycles	60, 60	v600 (600 mm/s)
5 Work cycles	100, 100	v1000 (1000 mm/s)
More than 5 Work cycles	100, 100	Max.

If the program consists of large wrist movements, it is possible that the reorientation velocity, which is always high in predefined velocities, needs to be included in the ramping up.

3.3.9 Fitting equipment on the robot (robot dimensions)

Robot dimensions

The figure shows the dimension of the robot.



xx2200000423

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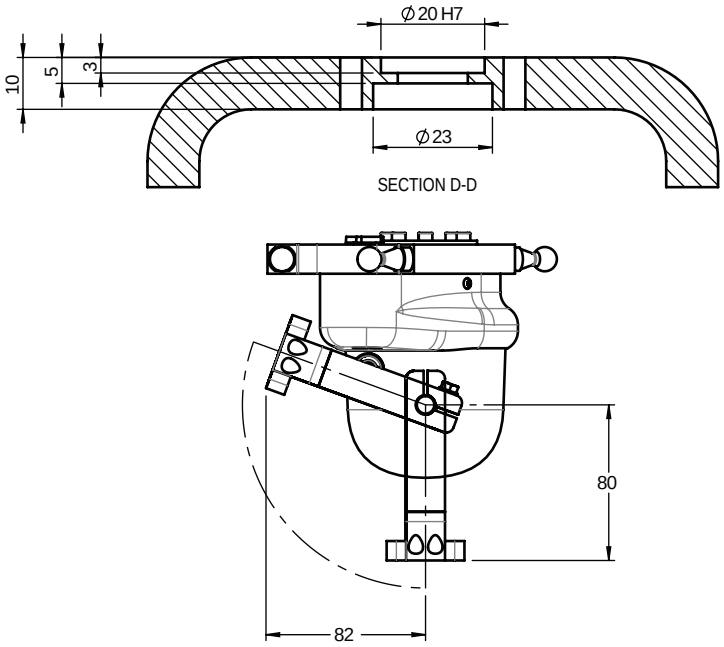
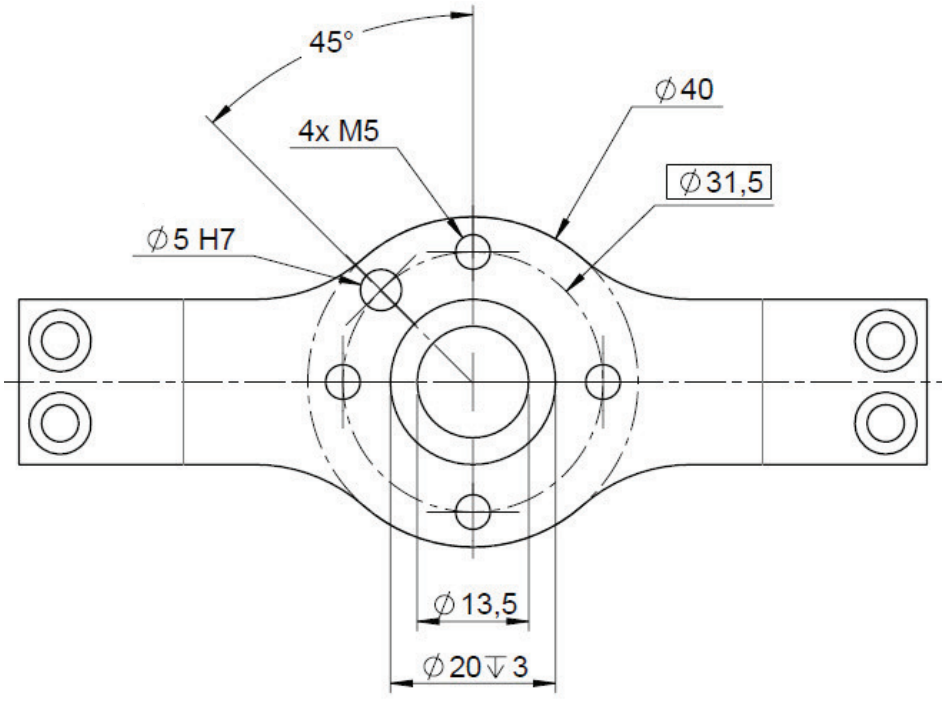
3.3.9 Fitting equipment on the robot (robot dimensions)
Continued



xx2200000433

Variant	a	b	c	d	e	f
IRB 365-1.5/800	811	1161	492	150	550	414
IRB 365 1.5/1100	861	1261	642	175	550	375
IRB 365-1.5/1300	961	1361	742	190	650	471

Mechanical interface of the tool flange



xx2100000962

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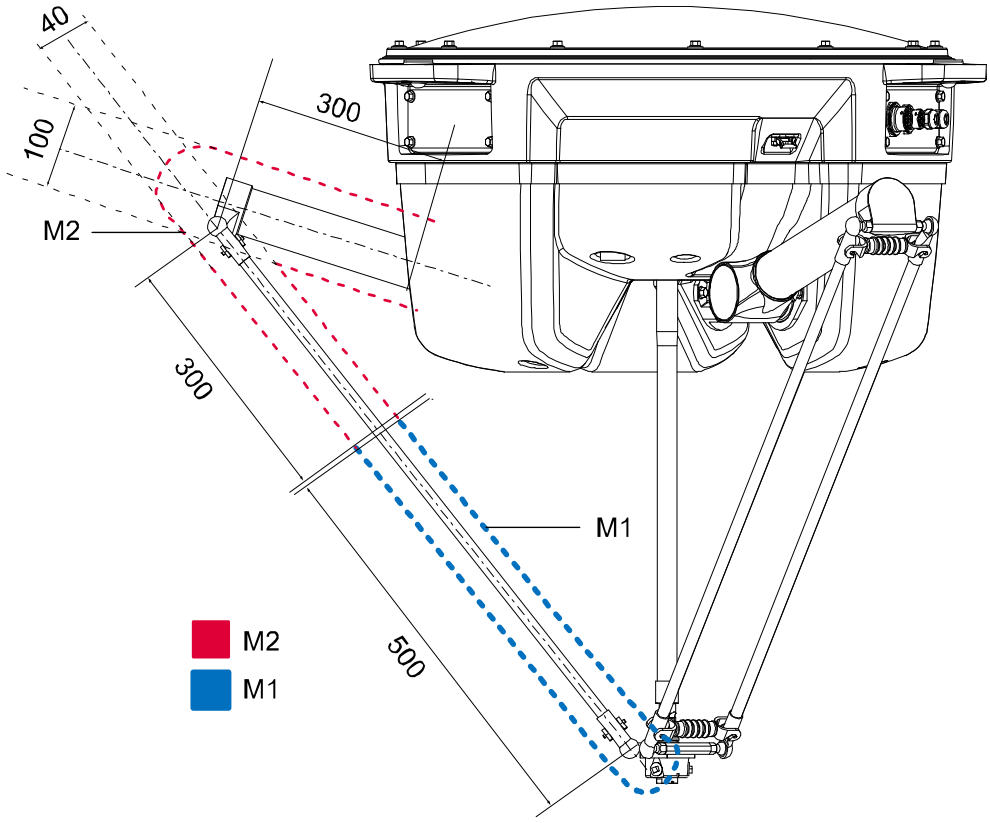
3.3.9 Fitting equipment on the robot (robot dimensions)
Continued

Extra equipment attached to the manipulator arms

Extra loads can be mounted on the manipulator. Definitions of dimensions and masses are shown in the following figures. Maximum allowed arm load depends on center of gravity of arm load and robot payload.

Center of gravity for extra loads on upper and lower arms



xx0700000716

M1	Limitation lines for center of gravity for M1
M2	Limitation lines for center of gravity for M2

Attachment of extra loads on the upper and lower arms

No holes for fitting extra equipment are available on the upper and lower arms. If attaching extra equipment to the arms, use shaped clamping blocks. Plastic cable ties can be used but risk of damaging surfaces. Do not use metal directly on the lower arms. Maximum extra load: 0.35 kg to either M1 or M2.

Equipment attached to M1 and/or M2 should be calculated as a point load located in the same position as TCPO. This point load needs to be added to the calculation of the users normal tool load and declared in used tool data.

3.4 Electrical connections

3.4.1 Robot cabling and connection points

Introduction

Connect the robot and controller to each other after securing them to the foundation. The lists below specify which cables to use for each respective application.

DANGER

Turn off the main power before connecting any cables.

CAUTION

Verify that the robot serial number is according to the number(s) in the *Declaration of Incorporation* (DoI).

Main cable categories

The following table specifies cabling categories between the robot and the controller. Some of the cabling belong to optional applications.

Cable category	Description
Robot cables	Handles power supply to and control of the robot's motors as well as feedback from the serial measurement board. Specified in the table *Robot cables on page 67*.
Customer cables	Handles communication with equipment fitted on the robot by the customer, low voltage signals and high voltage power supply + protective ground. The customer cables also handle databus communication. See the product manual for the controller, see document number in *References on page 10*.

Robot cables

These cables are included in the standard delivery. They are completely pre-manufactured and ready to plug in.

Cable sub-category	Description	Connection point, cabinet	Connection point, robot
Robot cables, power	Transfers drive power from the drive units in the control cabinet to the robot motors.	XS1	R1.MP
Robot cable, signals	Transfers resolver data from and power supply to the serial measurement board.	XS2	R1.SMB

Robot cable, power

Power cable length	Article number
Power cable 3 m	3HAC079766-008
Power cable 7 m	3HAC079766-001

Continues on next page

3.4.1 Robot cabling and connection points
Continued

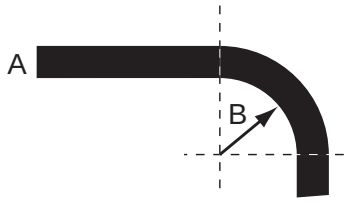
Power cable length	Article number
Power cable 15 m	3HAC079766-004
Power cable 22 m	3HAC079766-005
Power cable 30 m	3HAC079766-006

Robot cable, signals

Signal cable length	Article number
Signal cable, shielded: 3 m	3HAC084767-001
Signal cable, shielded: 7 m	3HAC084767-002
Signal cable, shielded: 15 m	3HAC084767-003
Signal cable, shielded: 22 m	3HAC084767-005
Signal cable, shielded: 30 m	3HAC084767-004

Bending radius for static floor cables

The minimum bending radius is 10 times the cable diameter for static floor cables.



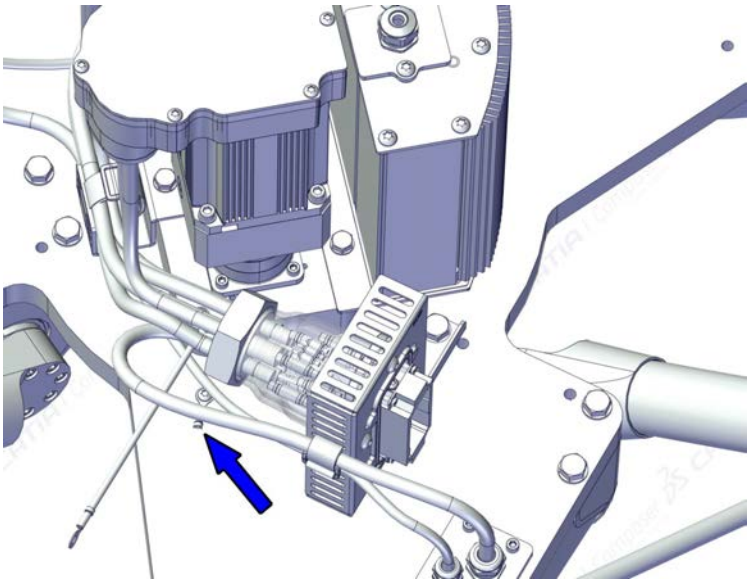
xx1600002016

A	Diameter
B	Diameter x10

Continues on next page

Grounding and bonding point on manipulator

There is a grounding/bonding point on the manipulator base. The grounding/bonding point is used for potential equalizing between control cabinet, manipulator and any peripheral devices.



xx2200000123

3.5 Test run after installation, maintenance, or repair

Safe handling

Use the following procedure after installation, maintenance, or repair, before initiating motion.

DANGER

Initiating motion without fulfilling the following aspects, may increase the risk for injury or cause damage to the robot.

	Action
1	Remove all tools and foreign objects from the robot and its working area.
2	Verify that the robot is properly secured to its position by all screws, before it is powered up.
3	Verify that any safety equipment installed to secure the position or restrict the robot motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Verify that all safety equipment is installed, as designed for the application.
6	Verify that no personnel are inside the safeguarded space.
7	If maintenance or repair has been done, verify the function of the part that was maintained.
8	Verify the application in the operating mode manual reduced speed.

Collision risks

CAUTION

When programming the movements of the robot, always identify potential collision risks before initiating motion.

4 Maintenance

4.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the IRB 365.

It is based on the maintenance schedule found at the beginning of the chapter. The schedule contains information about required maintenance activities including intervals, and refers to procedures for the activities.

Each procedure contains all the information required to perform the activity, including required tools and materials.

The procedures are gathered in different sections and divided according to the maintenance activity.

Safety information

Observe all safety information before conducting any service work.

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 15* before performing any service work.

The maintenance must be done by qualified personnel in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

Note

If the IRB 365 is connected to power, always make sure that the IRB 365 is connected to protective earth and a residual current device (RCD) before starting any maintenance work.

For more information see:

- *Product manual - OmniCore C30*
- *Robot cabling and connection points on page 67*.

4.2 Maintenance schedule and expected component life

4.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the IRB 365:

- Calendar time: specified in months regardless of whether the system is running or not.
- Operating time: specified in operating hours. More frequent running means more frequent maintenance activities.

Robots with the functionality *Service Information System* activated can show active counters in the device browser in RobotStudio, or on the FlexPendant.

4.2.2 Maintenance schedule

Scheduled and non-predictable maintenance

The robot must be maintained regularly to ensure proper function. The maintenance activities and intervals are specified in the table below.

Non-predictable situations also give rise to inspections of the robot. Any damage must be attended to immediately.

Life of each component

The inspection intervals *do not* specify the life of each component. Values for these are specified in the section *Expected component life on page 74*

Maintenance schedule

Maintenance activities	Regularly	Every 6 months	Every 12 months	Every 36 months	Every 8,000 hours [i]	Every 12,000 hours	Every 20,000 hours	Every 40,000 hours	Reference
Cleaning the robot	x								*Cleaning the IRB 365 on page 94*
Inspecting the telescopic shafts		x							*Inspecting the telescopic shafts on page 80*
Inspecting the lower arms		x							*Inspecting the telescopic shafts on page 80*
Replacing the SMB battery pack				x [ii]					*Changing the SMB battery on page 89*
Replacing the ball bearing cup			x [iii]						*Replacing ball bearing cup on page 117*
Replacing the slide bearings			x [iv]						*Inspecting the telescopic shafts on page 80*

i Operating hours counted by the DTC = Duty Time Counter
ii The battery is to be replaced at given maintenance interval or at battery low alert.
iii The ball bearing cups is to be replaced every 12 months or every 3800 hours which ever comes first
iv The slide bearings is to be replaced every 12 months or every 3000 hours which ever comes first

4.2.3 Expected component life

Expected life depends on usage

The expected life of a specific component of the robot can vary greatly depending on how hard it is run.

Expected component life

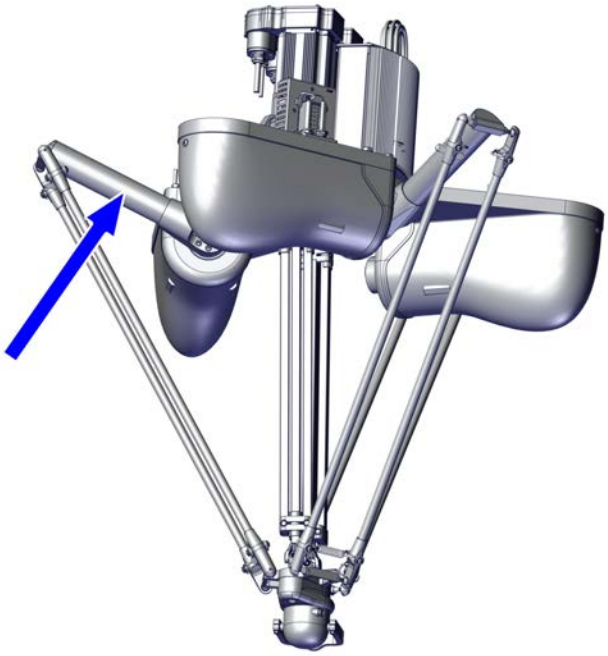
Component	Expected life	Note
Gearboxes	20,000 hours	

4.3 Inspection activities

4.3.1 Inspecting the upper arms

Location of the upper arm

The figure shows a 5-axis IRB 365.



xx2100000720

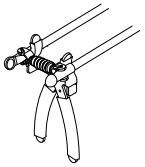
Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	

Continues on next page

4.3.1 Inspecting the upper arms

Continued

Equipment	Article number	Note	Image
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

DANGER

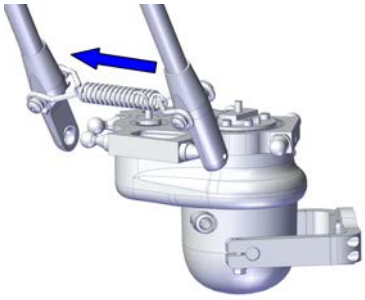
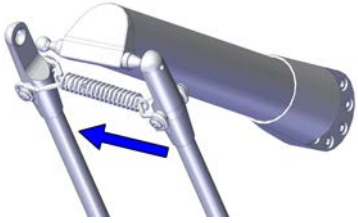
Turn off all:

- electric power supply
- hydraulic pressure supply
- air pressure supply

to the robot, before entering the safeguarded space.

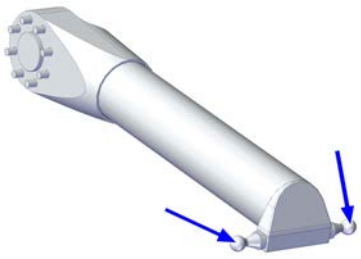
Inspecting the upper arms

Removing the lower arm

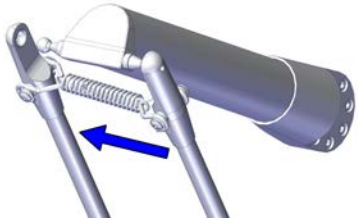
	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Remove the lower end of the lower arms from the delta unit by using the pliers, either on the left side or the right side, not both.	 xx2100000722
3	Remove the upper end of the lower arms from the upper arms by using the pliers, either on the left side or the right side, not both.	 xx2100000721
4	Remove the lower arms.	

Continues on next page

Inspecting the upper arm

	Action	Note
1	Check the surface of the tube for cracks, if necessary replace the part.	 xx2100000839 *Replacing the upper arms on page 119*
2	Check surface of ball joints for cracks or burrs.	 xx2100000840 *Replacing ball joint on page 116*
3	Check tightening torque on attachment screws upper arm. Add Loctite 243 if removing a screw.	Tightening torque: 16 Nm.  xx2100000841

Refitting the lower arm

	Action	Note
1	Refit the lower arm to the upper arm by using the pliers, either on the left side or the right side, not both. **Note** Be careful not to damage the ball bearing cups	 xx2100000721
2	Repeat the procedure in the lower end of the lower arms, on the delta unit.	

Continues on next page

4.3.1 Inspecting the upper arms

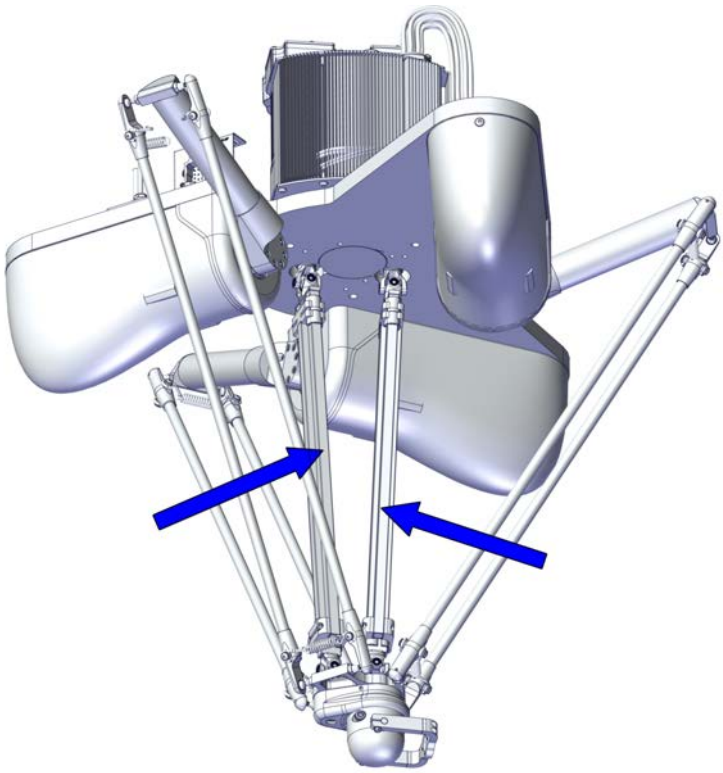
Continued

	Action	Note
3	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

4.3.2 Inspecting the telescopic shafts

Location of the telescopic shafts

The figure shows a 5-axis IRB 365.



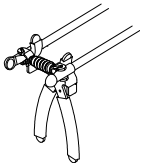
xx2100000730

Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	

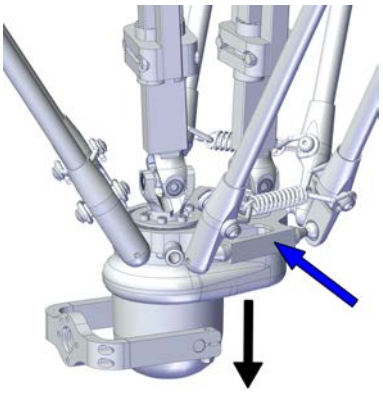
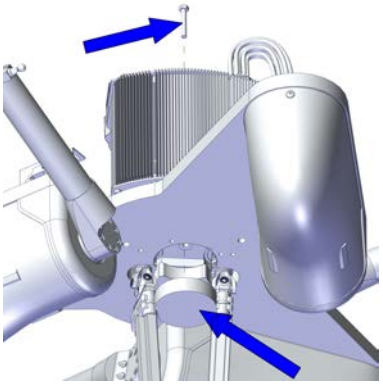
Continues on next page

4.3.2 Inspecting the telescopic shafts
Continued

Equipment	Article number	Note	Image
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

Inspecting the telescopic shafts

Removing the telescopic shaft

	Action	Note
1	**WARNING** Make sure that all supplies for hydraulic pressure and air pressure are turned off.	
2	Push the brake release button and press the delta plate with head downwards to extend the two telescopic shafts. **Note** Make sure not to over extend the length of telescope shafts due to slide bearing damage	 xx2100000747
3	**WARNING** Turn off all: • electric power supply	
4	Remove the center base cover.	 xx2100000732

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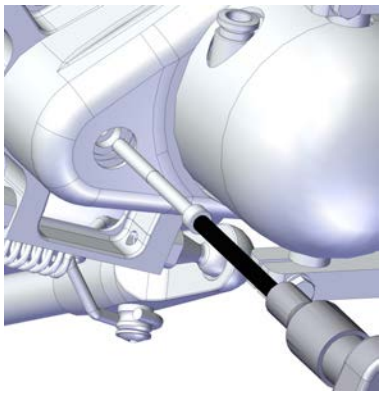
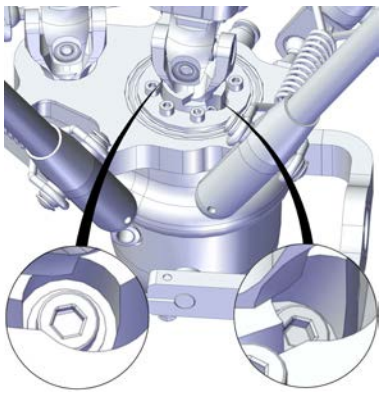
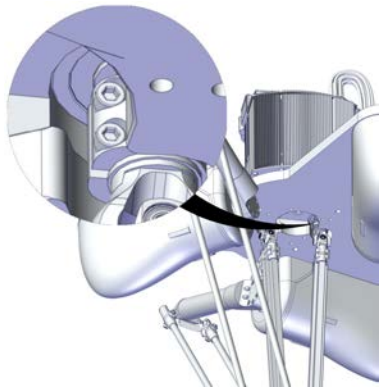
	Action	Note
5	Remove the attachment screw for telescopic shaft (axis 4).	 xx2100000735
6	Remove the two attachment screws with washers for telescopic shaft (axis 5).	 xx2100000736
7	Loosen the two attachment screws on the mounting clamp in the upper end of the telescopic shaft.	 xx2100000729

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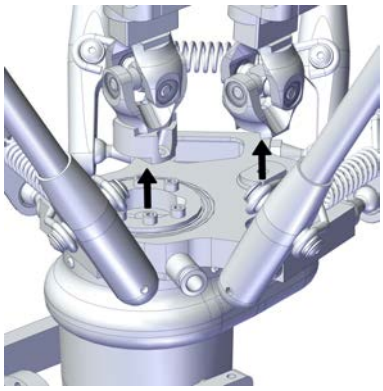
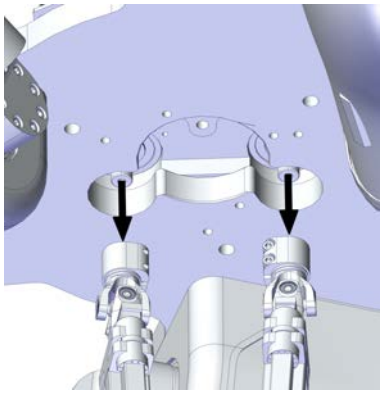
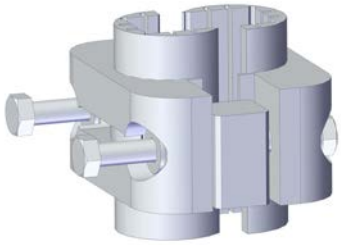
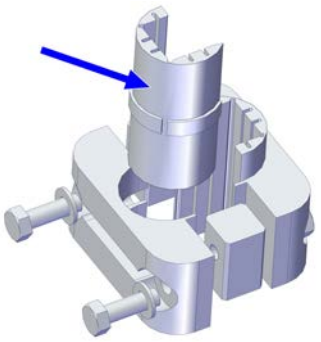
4.3.2 Inspecting the telescopic shafts

Continued

	Action	Note
8	Push the telescopic shaft together. **Note** Use light force with mallet if necessary	 xx2100000749
9	Remove the telescopic shaft for axes 4 and 5.	 xx2100000733
10	Loosen the attachment screw, and remove the conical connection from the telescopic shaft for axis 5.	 xx2100000751

	Action	Note
1	Check the screws and the joints on the telescope bearing housing. Add Loctite 243 if replacing any screw.	Tightening torque 7 Nm  xx2100000773

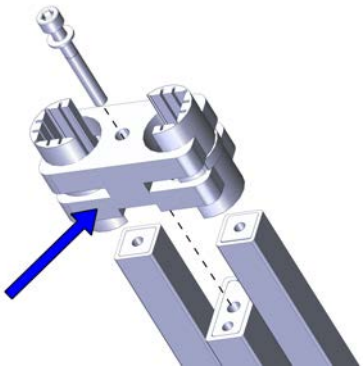
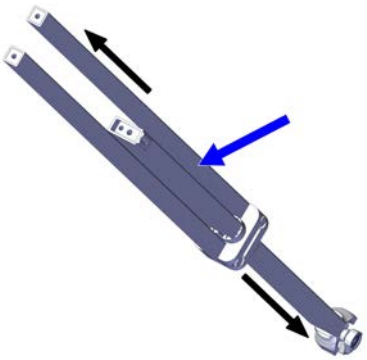
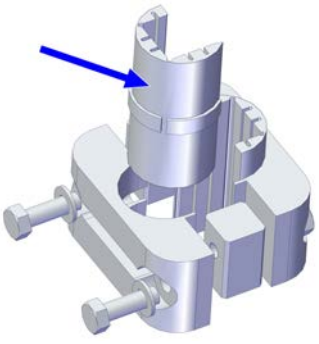
Continues on next page

	Action	Note
2	Check the slide bearings, replace if damaged.	 xx2100000760

Continues on next page

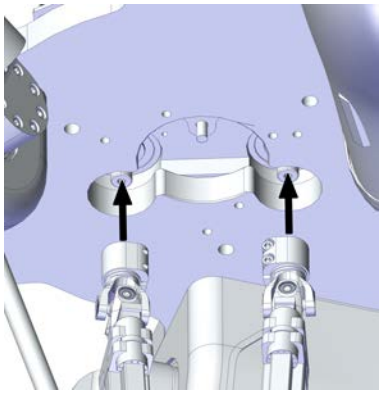
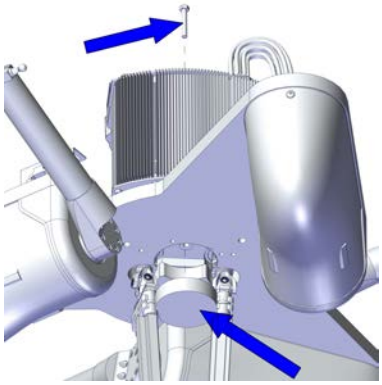
4.3.2 Inspecting the telescopic shafts

Continued

	Action	Note
3	Check the universal joints for any damage or cracks. If damage or cracks are detected, replace the complete joint.	 xx2100000753  xx2100000754  xx2100000755  xx2100000760

Continues on next page

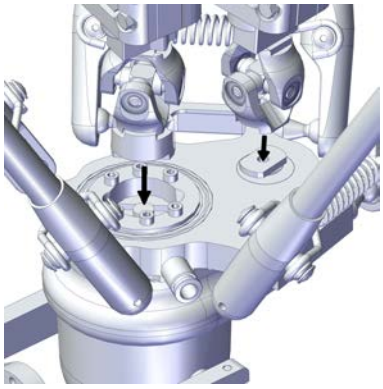
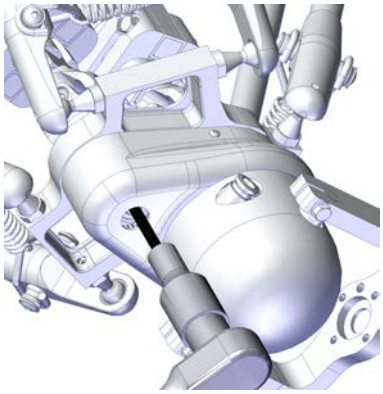
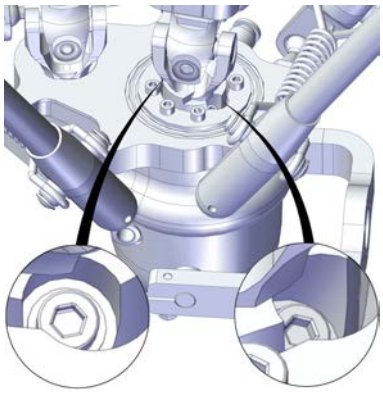
Refitting the telescopic shaft

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Move the conical connection over to the new telescopic shaft axis 5. Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	Tightening torque: 10 Nm  xx2100000751
3	Refit the two telescopic shafts on the motor axis 4 and 5.	 xx2100000750
4	Tighten mounting clamping screws.	Tightening torque: 10 Nm
5	Refit the center base cover.	 xx2100000732

Continues on next page

4.3.2 Inspecting the telescopic shafts

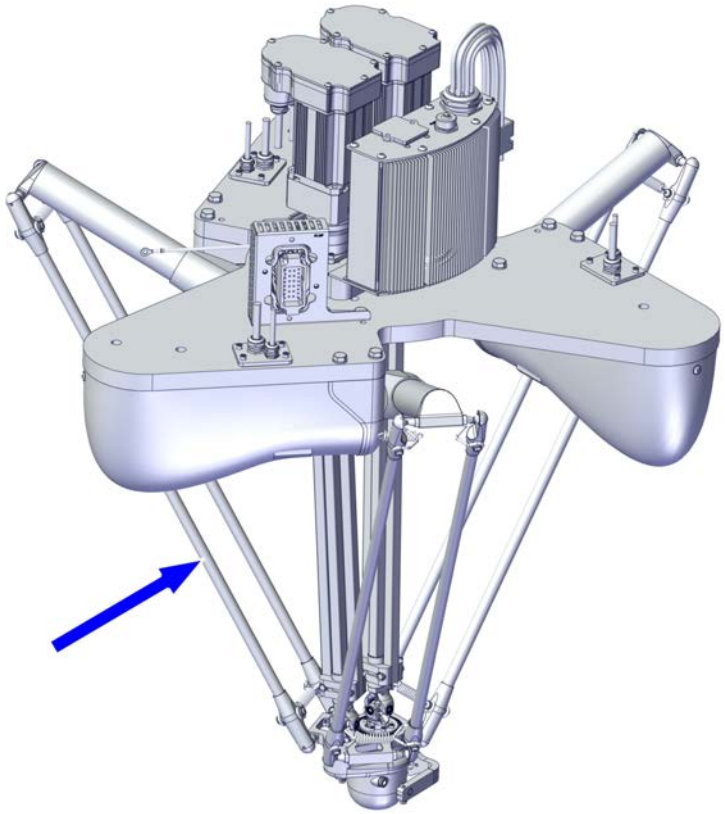
Continued

	Action	Note
6	Pull out the telescopic shaft and fit the conical coupling into the corresponding coupling on the delta plate Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	10 Nm  xx2100000752
7	Refit the attachment screw for telescopic shaft and tighten (axis 4). Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	Tightening torque: 10 Nm  xx2100000748
8	Refit the two attachment screws for telescopic shaft and tighten (axis 5). Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	Tightening torque: 1.6 Nm  xx2100000736
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

4.3.3 Inspecting the lower arms

Location of the lower arms

The figure shows a 5-axis IRB 365.



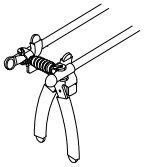
xx2100000719

Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	

Continues on next page

4.3.3 Inspecting the lower arms
Continued

Equipment	Article number	Note	Image
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

Inspecting the lower arms

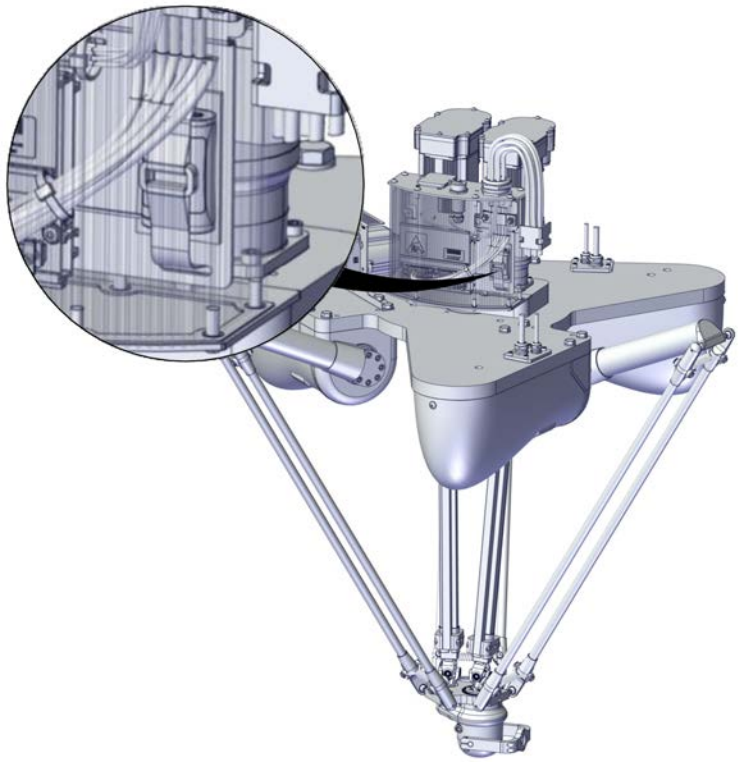
	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	Check the ball bearing cups for wear, and change if damage.	See *Replacing ball bearing cup on page 117*
3	If damage or cracks are detected, replace the lower arm.	See *Replacing the lower arms on page 114*.

4.4 Replacement/changing activities

4.4.1 Changing the SMB battery

Location of the battery

The battery is located as shown in the figure.



xx2100000842

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Battery unit	3HAC044075-001	Battery includes protection circuits. Only replace with the specified spare part or an ABB-approved equivalent.

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

Continues on next page

4.4.1 Changing the SMB battery

Continued

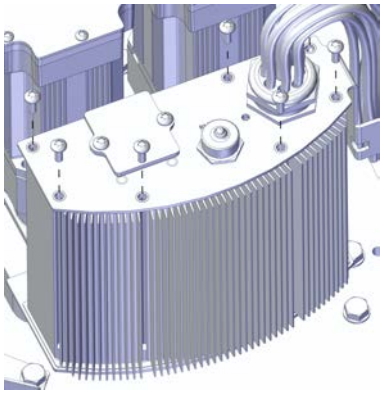
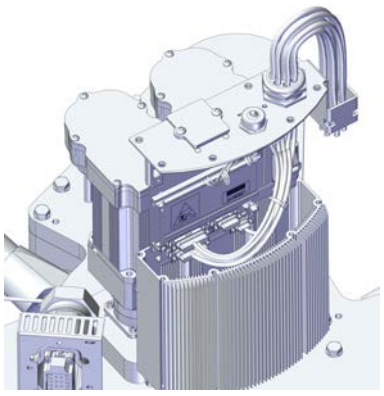
Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

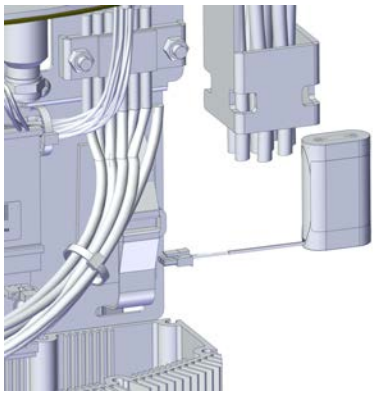
Removing the SMB battery

Use this procedure to remove the SMB battery.

Removing the SMB battery

	Action	Note
1	Jog the robot to calibration position.	This is done to facilitate updating of the revolution counter.
2	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
3	**ELECTROSTATIC DISCHARGE (ESD)** The unit is sensitive to ESD. Before handling the unit read the safety information in section *The unit is sensitive to ESD on page 42*.	
4	Remove the SMB cover attachment screws. **CAUTION** Clean cover from metal residues before opening. Metal residues can cause shortage on the boards which can result in hazardous failures.	 xx2100000843
5	Pull the SMB assembly out of the SMB box.	 xx2100000956

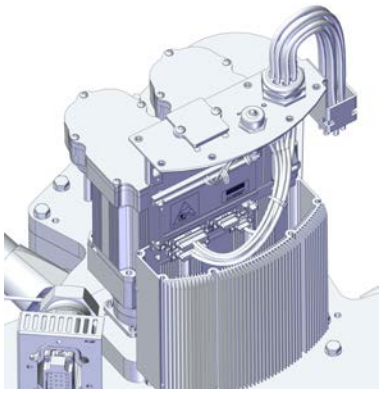
Continues on next page

	Action	Note
6	Carefully pull out the battery and disconnect the battery cable. • Battery cable connector R2.G.	 xx2100000957
7	Remove the SMB battery. Battery includes protection circuits. Only replace with a specified spare part or with an ABB-approved equivalent.	

Refitting the SMB battery

Use this procedure to refit the SMB battery.

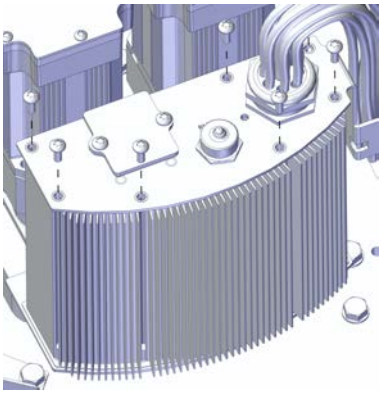
Refitting the SMB battery

	Action	Note
1	Connect the battery cables and place the battery under the rubber band. • Battery cable connector R2.G.	
2	Carefully push down the SMB assembly into the SMB box.	 xx2100000956

Continues on next page

4.4.1 Changing the SMB battery

Continued

	Action	Note
3	Fasten the battery cover and sealing, with lubricated screws and washers. **Note** Do not overtighten to avoid damaging the sealing.	Tightening torque: 10 Nm  xx2100000843
4	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

4.5 Lubrication activities

Lubrication

Motors and gears on the IRB365 are lifetime lubricated and maintenance-free.

4.6 Cleaning activities

4.6.1 Cleaning the IRB 365

General

To secure high uptime it is important that the IRB 365 is cleaned regularly. The frequency of cleaning depends on the environment in which the manipulator works.

Different cleaning methods are allowed depending on the type of protection of the IRB 365.

Note

Always verify the protection type of the robot before cleaning.

WARNING

Turn off all electrical power supplies to the robot before starting the cleaning.

Special cleaning considerations

This section specifies some special considerations when cleaning the robot.

- Always use cleaning equipment as specified. Any other cleaning equipment may shorten the life of the robot.
- Always check that all protective covers are fitted to the robot before cleaning.
- Do not point the water jet at connectors, joints, sealings or gaskets.
- Do not use compressed air to clean the robot.
- Do not use solvents that are not approved by ABB to clean the robot.
- Do not remove any covers or other protective devices before cleaning the robot.

Cleaning methods

This following table defines what cleaning methods are allowed for ABB manipulators depending on the protection type.

Protection type	Cleaning method			
	Vacuum cleaner	Wipe with cloth	Rinse with water	High pressure water, steam or spray
Standard	Yes	Yes [i].	No	No

[i] The robot contains moving mechanical contacts (e.g. seals). Naturally these contacts can release wear particles and minor amounts of grease during their lifetime. Cleaning these areas as part of the normal cleaning routine of the robot is recommended.

5 Repair

5.1 Introduction

Structure of this chapter

This chapter describes repair activities for the IRB 365. Each procedure contains the information required to perform the activity, for example spare parts numbers, required special tools, and materials.

WARNING

Repair activities not described in this chapter must only be carried out by ABB.

Report replaced units

Note

When replacing a part on the IRB 365, report to your local ABB the serial number, the article number, and the revision of both the replaced unit and the replacement unit.

This is particularly important for safety equipment to maintain the safety integrity of the installation.

Safety information

Make sure to read through the chapter *Safety on page 15* before commencing any service work.

Note

If the IRB 365 is connected to power, always make sure that the IRB 365 is connected to protective earth and a residual current device (RCD) before starting any repair work.

For more information see:

- *Product manual - OmniCore C30*

5.2 Definition of spare part levels

Spare part level

ABB spare parts are categorized into two levels, L1 and L2. Always check the part level before conducting a service work on a spare part.

- L1 spare parts

  The L1 parts can be replaced in the field. The maintenance and replacement instructions given in the related product manuals must be strictly followed. If there are any problems, contact your local ABB for support.

- L2 spare parts

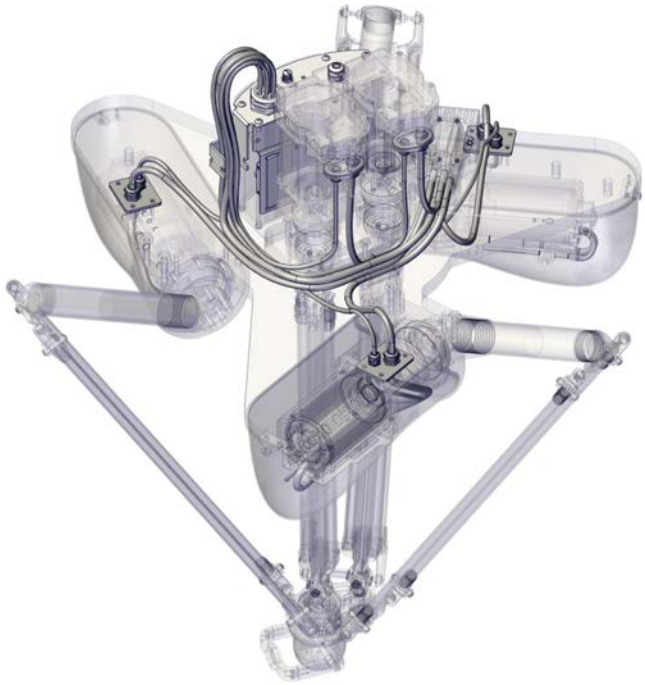
  To replace the L2 parts require specialized training and might need special tools. Only ABB field service personnel or qualified personnel trained by ABB can replace L2 parts.

5.3 Base

5.3.1 Replacing the manipulator harness

Location of the manipulator harness

The manipulator harness is located as shown in the figure.



xx2100001811

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Cable harness	3HAC080571-001		L1

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

Continues on next page

5.3.1 Replacing the manipulator harness
Continued

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

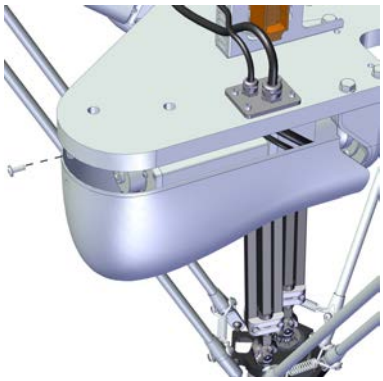
Removing the manipulator harness

Use these procedures to remove the manipulator harness.

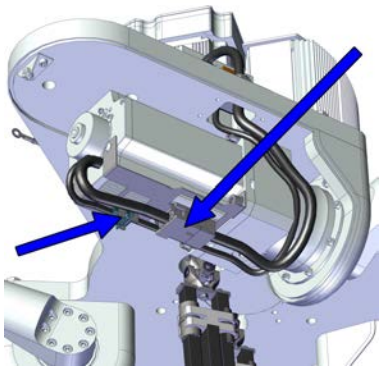
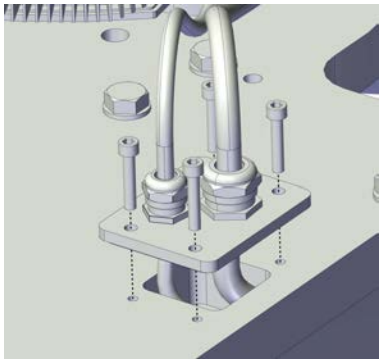
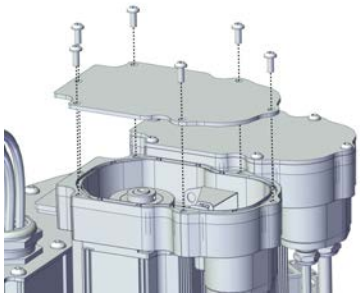
Preparations before removing the manipulator harness

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the manipulator harness

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Remove the motor cover axis 1, 2 and 3.	 xx2100000725

Continues on next page

	Action	Note
3	Disconnect the two cable connectors on motor axis 1, 2 and 3.	 xx2100000967
4	Remove the sealing plate by removing the four screws on motor axis 1, 2 and 3.	 xx2100001814
5	Remove motor cover from motor axis 4 and 5.	 xx2100001418

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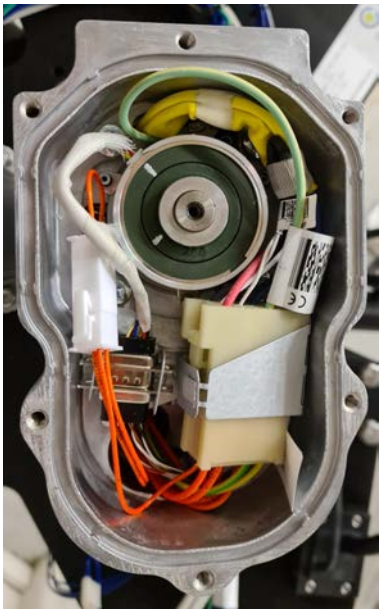
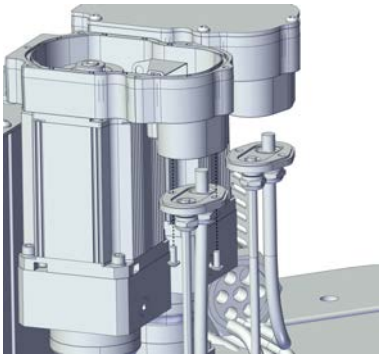
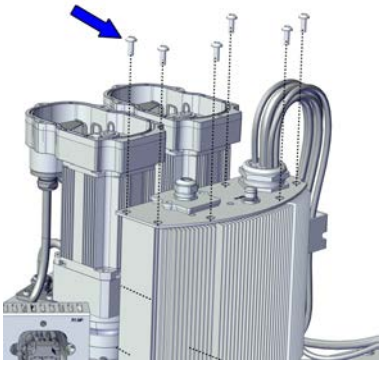
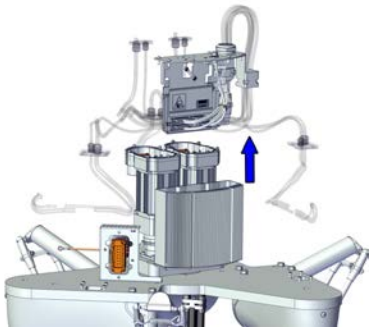
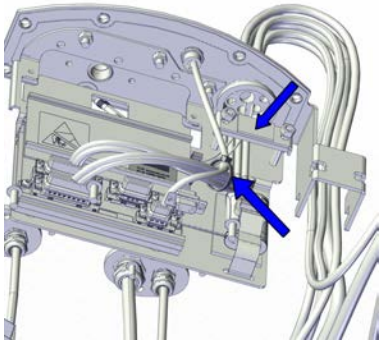
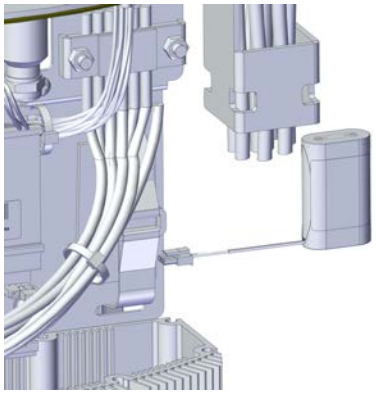
5.3.1 Replacing the manipulator harness

Continued

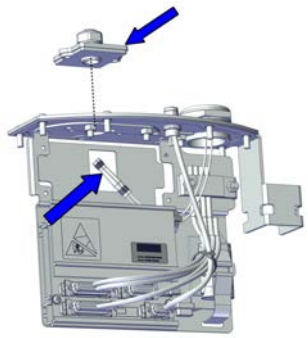
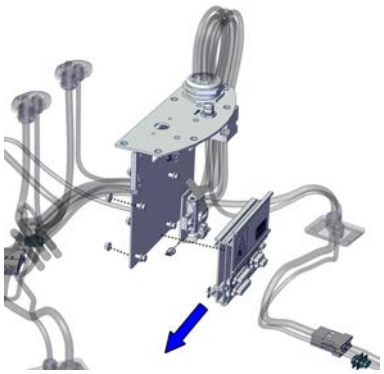
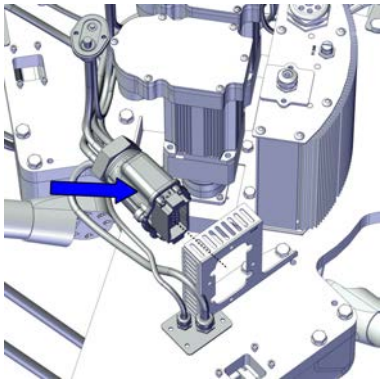
	Action	Note
6	Disconnect the white connector and the yellow connector on the motor top.	 xx2200000212
7	Remove the two screws and remove the cover with cable glands.	 xx2100001419
8	Remove the attachment screws on the SMB box top cover.	 xx2100002738

Continues on next page

	Action	Note
9	Pull the manipulator harness out of the SMB box.	 xx2100002739
10	**ELECTROSTATIC DISCHARGE (ESD)** When handling the computer outside of the controller, use the wrist strap button located on the side of the computer.	
11	Cut cable straps Remove the screen grounding plate	 xx2100001977
12	Carefully pull out the battery and disconnect the battery cable. • Battery cable connector R2.G.	 xx2100000957
13	Remove the SMB battery. Battery includes protection circuits. Only replace with a specified spare part or with an ABB-approved equivalent.	

Continues on next page

5.3.1 Replacing the manipulator harness
Continued

	Action	Note
14	Remove the brake release sealing plate on the SMB box top cover. Disconnect the two cables from the brake release sealing plate.	 xx2100002737
15	Loosen the four nuts and slide the SMB unit from the manipulator harness.	 xx2100002740
16	Remove the two screws and remove the connector from the bracket.	 xx2100002806

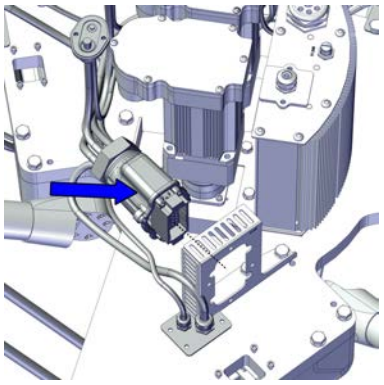
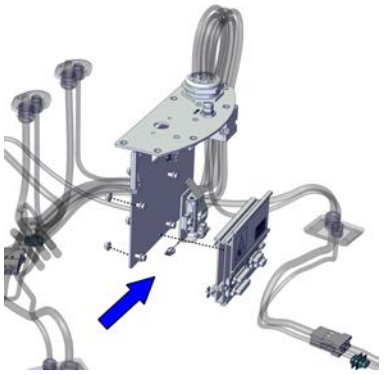
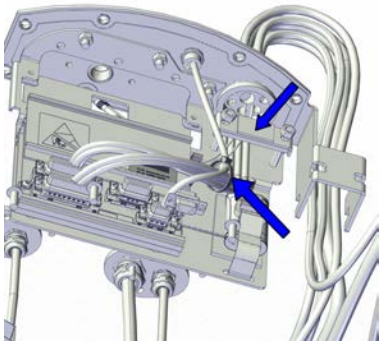
Refitting the manipulator harness

Use these procedures to refit the cable harness.

Refitting the manipulator harness

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	Refit the connector to the bracket and tighten two screws.	Tightening torque: 10 Nm  xx2100002806
3	Refit the SMB-unit on the manipulator harness.	 xx2100002813
4	Connect cable straps and refit the screen grounding plate.	 xx2100001977

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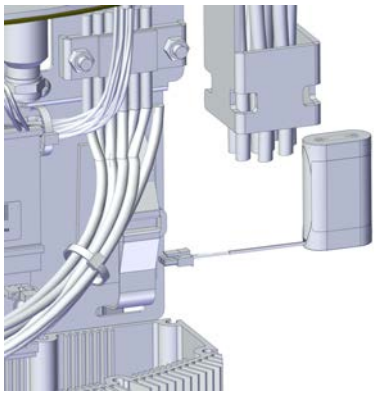
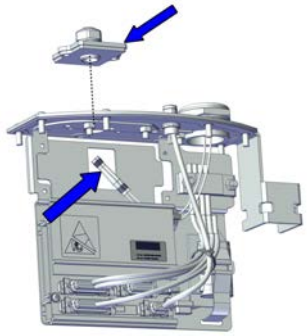
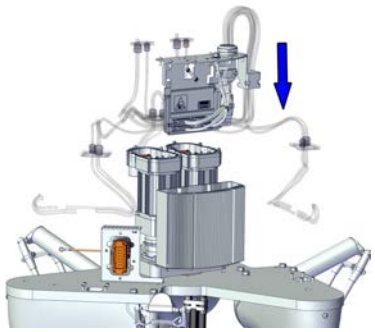
5.3.1 Replacing the manipulator harness

Continued

	Action	Note
5	Connect the battery cables and place the battery under the rubber band. • Battery cable connector R2.G.	 xx2100000957
6	Refit the two cables for brake release unit. Add Loctite 5700 thread sealant on the two screws. Refit the brake release sealing plate on the SMB box top cover.	2 Nm  xx2100002737
7	Refit the manipulator harness in the SMB box.	 xx2100002742

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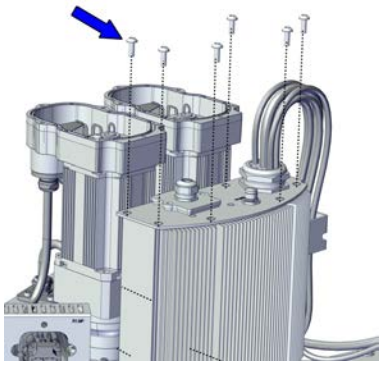
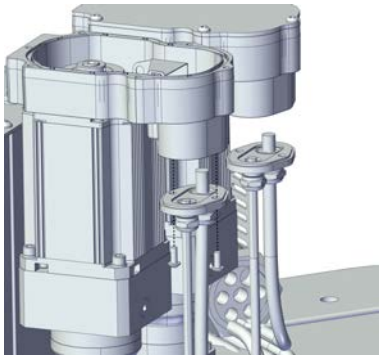
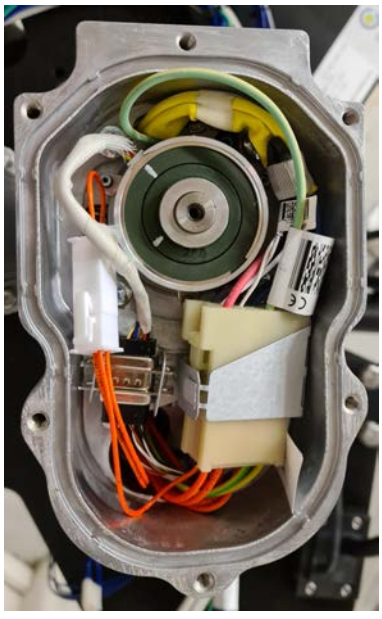
	Action	Note
8	Tighten the attachment screws on the SMB box top cover.	Tightening torque: 10 Nm  xx2100002738
9	Refit the cover with cable glands and tighten two screws.	3.5 Nm  xx2100001419
10	Reconnect the white connector and the yellow connector on the motor top.	 xx2200000212

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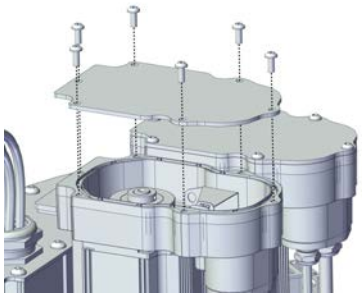
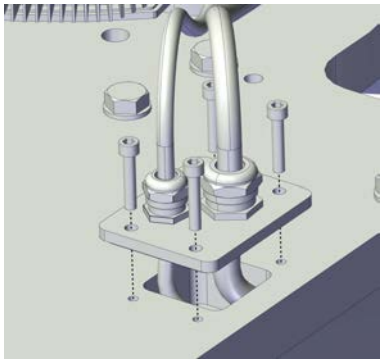
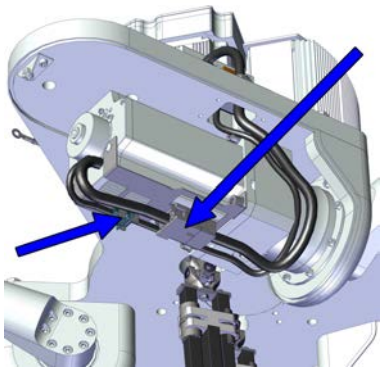
5.3.1 Replacing the manipulator harness

Continued

	Action	Note
11	Refit the motor cover to motor axis 4 and 5.	6 Nm  xx2100001418
12	Route the cables through the hole in the base and tighten four screws in the sealing plate.	3.5 Nm  xx2100001814
13	Reconnect the two cable connectors on motor axis 1, 2 and 3.	 xx2100000967

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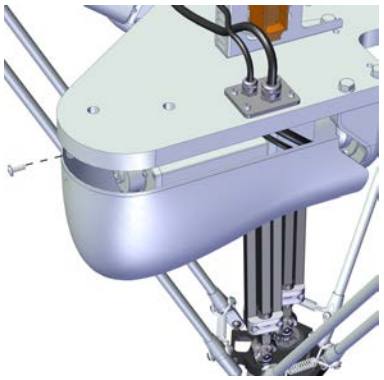
	Action	Note
14	Refit the motor cover axis 1, 2 and 3.	Tightening torque: 2 Nm  xx2100000725

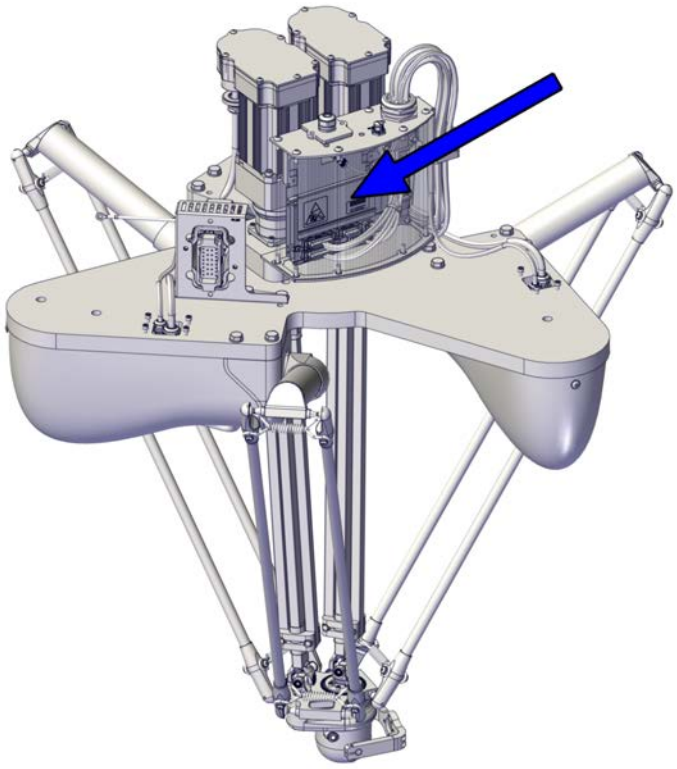
Concluding procedure

	Action	Note
1	Calibrate the robot.	See *Calibration information on page 191*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.3.2 Replacing the SMB unit

Location of the SMB unit

The SMB unit is located as shown in the figure.



xx2100001812

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
SMB unit	3HAC044168-001		

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

Continues on next page

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Removing the SMB unit

Use these procedures to remove the SMB unit.

Preparations before removing the SMB unit

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

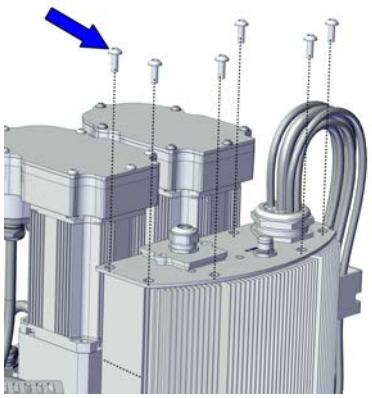
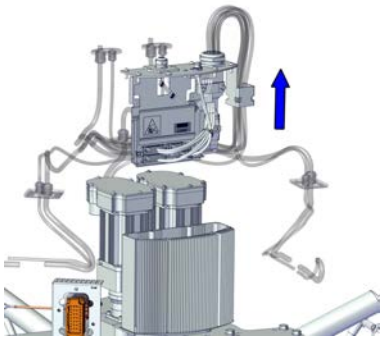
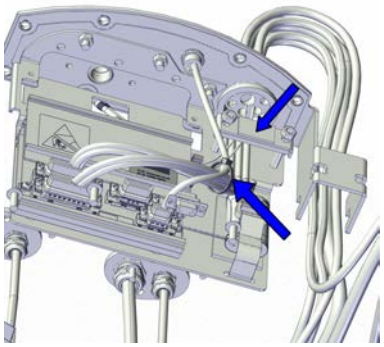
Removing the SMB unit

	Action	Note
1	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**ELECTROSTATIC DISCHARGE (ESD)** When handling the computer outside of the controller, use the wrist strap button located on the side of the computer.	

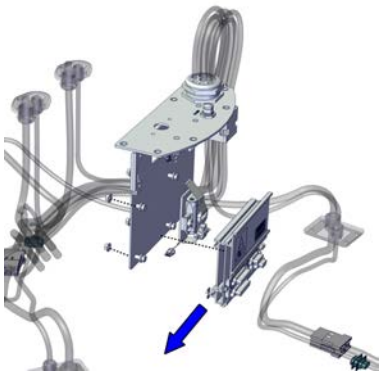
Continues on next page

5.3.2 Replacing the SMB unit

Continued

	Action	Note
3	Remove the attachment screws on the SMB box top cover.	 xx2100002751
4	Pull the SMB board out of the SMB box and disconnect the cable connectors.	 xx2100002750
5	Cut cable straps and remove the screen grounding plate disconnect cable harness.	 xx2100001977
6	Disconnect the battery cable • Battery cable connector R2.G.	

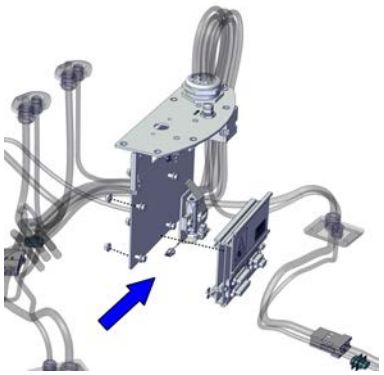
Continues on next page

	Action	Note
7	Loosen the 4 nuts and slide the SMB unit of the bracket.	 xx2100002740

Refitting the SMB unit

Use these procedures to refit the SMB unit.

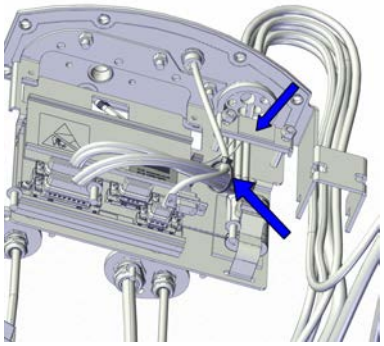
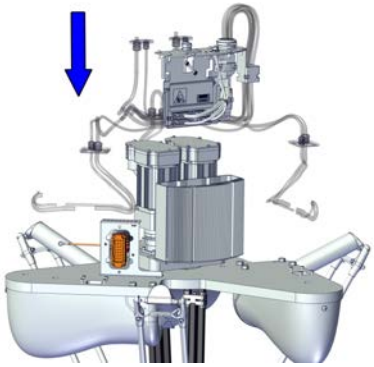
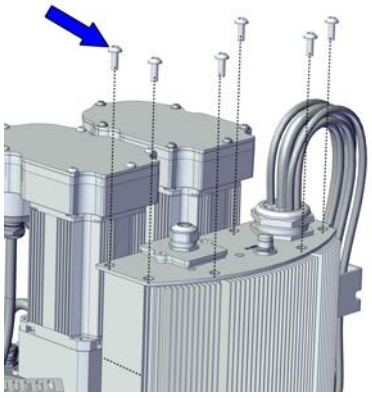
Refitting the SMB unit

	Action	Note
1	**ELECTROSTATIC DISCHARGE (ESD)** When handling the computer outside of the controller, use the wrist strap button located on the side of the computer.	
2	Fit the new SMB unit on the bracket and tighten 4 nuts.	Tightening torque: 3 Nm  xx2100002813

Continues on next page

5.3.2 Replacing the SMB unit

Continued

	Action	Note
3	Connect cable harness connectors and fit cable straps and the screen grounding plate.	 xx2100001977
4	Connect the battery cables • Battery cable connector R2.G.	
5	Push the SMB board in to the SMB box.	 xx2100002749
6	Tighten the attachment screws on the SMB box top cover.	Tighten torque: 10 Nm  xx2100002751

Concluding procedure

	Action	Note
1	Calibrate the robot.	See *Calibration information on page 191*.

Continues on next page

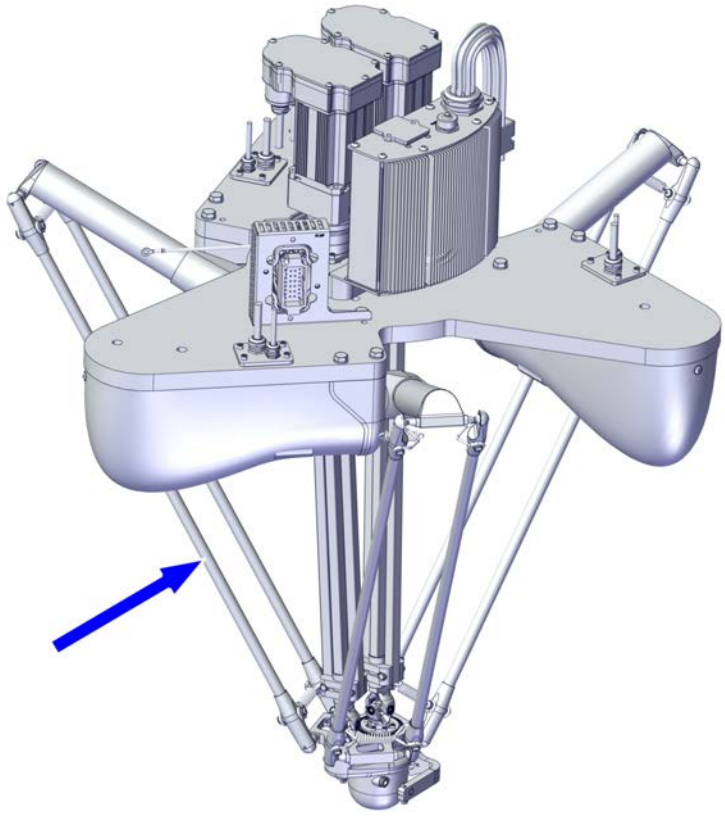
	Action	Note
2	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.4 Upper and lower arms

5.4.1 Replacing the lower arms

Location of the lower arms

The lower arms are located as shown in the figure.



xx2100000719

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Lower arm	**IRB 365-1.5/800**: 3HAC084339-001 **IRB 365 1.5/1100**: 3HAC079965-001 **IRB 365-1.5/1300**: 3HAC084334-001		L1
Ball joint	3HAC079978-001		L1

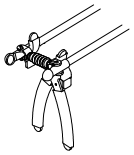
Continues on next page

Service parts

Following parts are affected during the replacement procedure. Replace if damaged or lost.

Spare part	Article number	Note
Ball bearing cup	3HAC079967-001	
Parallel arm spring	3HAC079966-001	
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

Removing the lower arms

Use these procedures to remove the lower arms.

Preparations before removing the lower arms

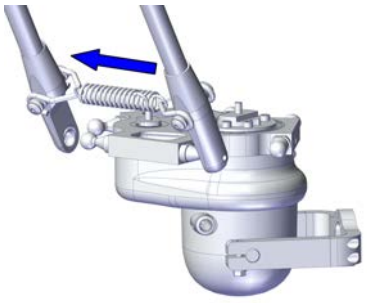
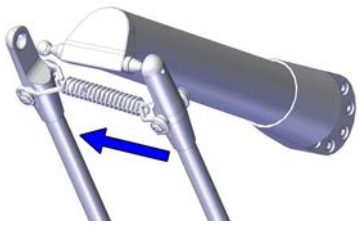
	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity. Do not move the position of the upper arms during lower arms replacement.	
2	**CAUTION** Turn off all supplies for electrical power to the robot, before starting the repair work.	
3	Remove any loads or tools attached to the tilt arm on the head.	

Removing the lower arm

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	

Continues on next page

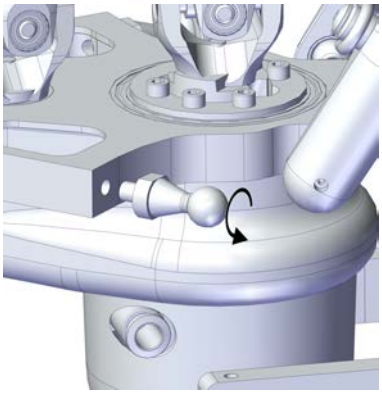
5.4.1 Replacing the lower arms
Continued

	Action	Note
2	Remove the lower end of the lower arms from the delta unit by using the pliers, either on the left side or the right side, not both.	 xx2100000722
3	Remove the upper end of the lower arms from the upper arms by using the pliers, either on the left side or the right side, not both.	 xx2100000721
4	Remove the lower arms.	

Replacing ball joint

Use these procedures to replace the ball joint.

Replacing ball joint

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Unscrew the ball joint counter clockwise.	 xx2100000781
3	Add Loctite 243 to the ball joint. Screw the ball joint clockwise into position.	Tightening torque: 12 Nm

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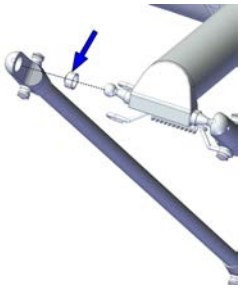
Replacing ball bearing cup

Use these procedures to replace the ball bearing cup.

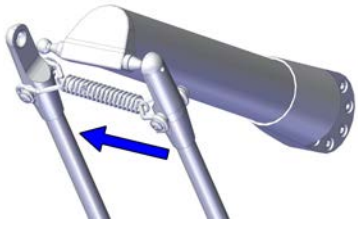
Replacing ball bearing cup

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Screw an M5 screw into the hole on the back of the cup holder Pull out the old ball bearing cup.	 xx2200000415
3	Push in the new ball bearing cup.	 xx2200000417

Refitting the lower arms

Use these procedures to refit the lower arms.

Refitting the lower arm

	Action	Note
1	Refit the lower arm to the upper arm by using the pliers, either on the left side or the right side, not both. **Note** Be careful not to damage the ball bearing cups	 xx2100000721
2	Repeat the procedure in the lower end of the lower arms, on the delta unit.	

Continues on next page

5.4.1 Replacing the lower arms

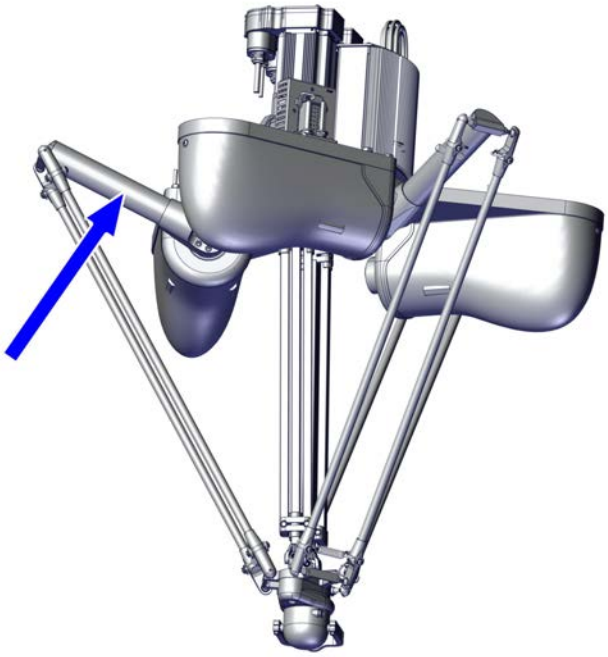
Continued

	Action	Note
3	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.4.2 Replacing the upper arms

Location of the upper arm

The upper arm is located as shown in the figure.



xx2100000720

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Upper arm	**IRB 365-1.5/800** and **IRB 365 1.5/1100**: 3HAC079964-001 **IRB 365-1.5/1300**: 3HAC084333-001		L1

Service parts

Following parts are affected during the replacement procedure. Replace if damaged or lost.

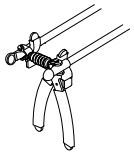
Spare part	Article number	Note
Ball bearing cup	3HAC079967-001	

Continues on next page

5.4.2 Replacing the upper arms
Continued

Spare part	Article number	Note
Parallel arm spring	3HAC079966-001	
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

Removing the upper arm

Use these procedures to remove the upper arm.

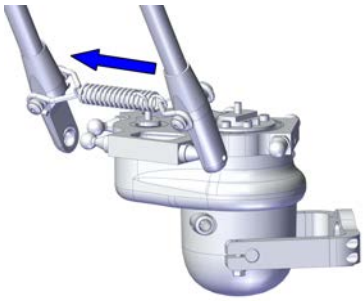
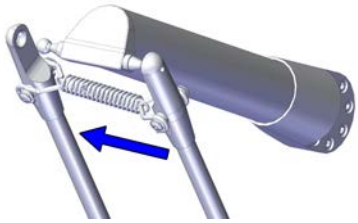
Preparations before removing the upper arm

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any loads or tools attached to the tilt arm on the head.	

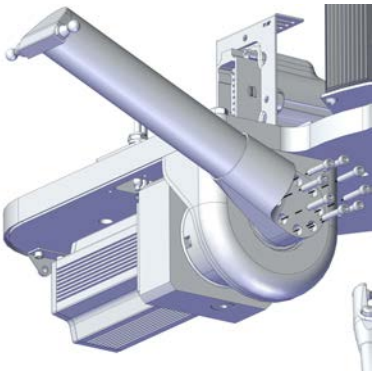
Removing the lower arm

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	

Continues on next page

	Action	Note
2	Remove the lower end of the lower arms from the delta unit by using the pliers, either on the left side or the right side, not both.	 xx2100000722
3	Remove the upper end of the lower arms from the upper arms by using the pliers, either on the left side or the right side, not both.	 xx2100000721
4	Remove the lower arms.	

Removing the upper arm

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Remove the 8 attachment screws holding the upper arm in the base unit.	 xx2100000726

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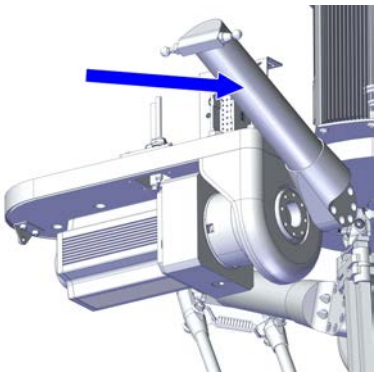
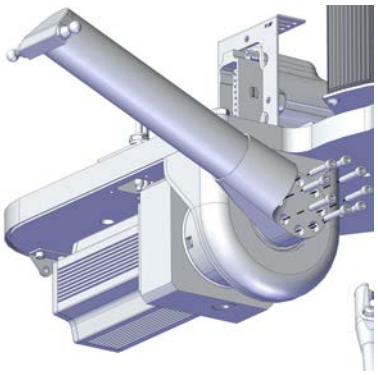
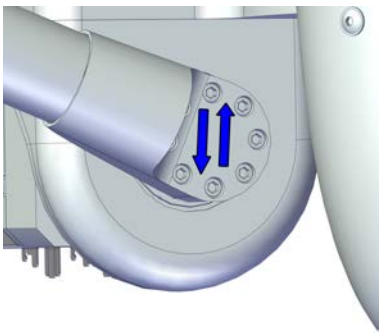
5.4.2 Replacing the upper arms
Continued

	Action	Note
3	Remove the upper arm from the base unit.	 xx2100000727

Refitting the upper arm

Use these procedures to refit the upper arm.

Refitting the upper arm

	Action	Note
1	Add Loctite 243 to all screws.	
2	Fit the upper arm to the base unit.	 xx2100000726
3	Refit the 8 attachment screws opposite each other.	Tightening torque: 16 Nm.  xx2100002383

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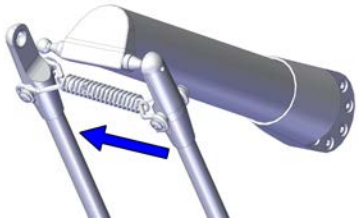
Refitting the lower arm

	Action	Note
1	Refit the lower arm to the upper arm by using the pliers, either on the left side or the right side, not both. **Note** Be careful not to damage the ball bearing cups	 xx2100000721
2	Repeat the procedure in the lower end of the lower arms, on the delta unit.	
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

Concluding procedure

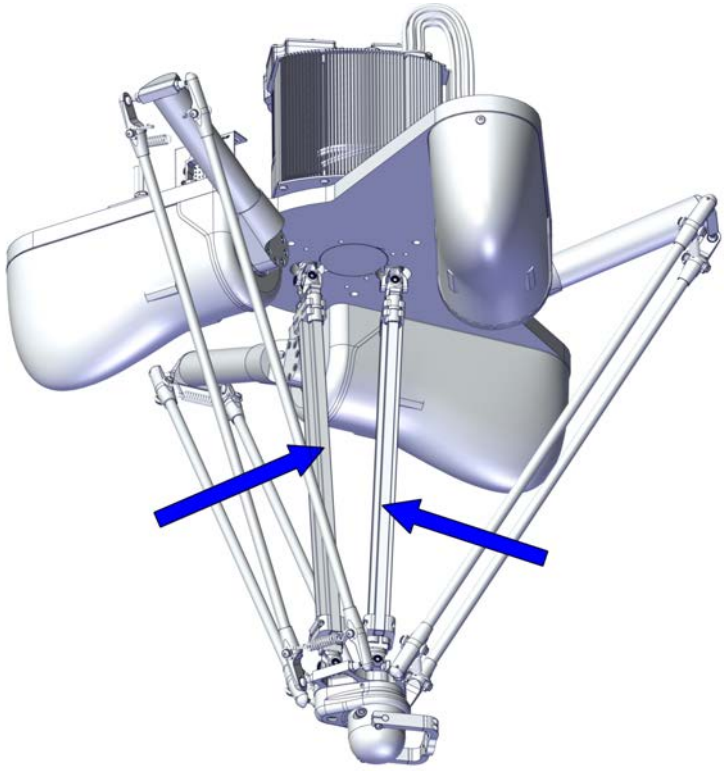
	Action	Note
1	Calibrate the robot.	See *Calibration information on page 191*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.4.3 Replacing the telescopic shafts and shaft components

Location of the telescopic shafts

The telescopic shafts are located as shown in the figure.

The figure shows a 5-axis IRB 365.



xx2100000730

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Telescope unit	**IRB 365-1.5/800**: 3HAC084342-001 **IRB 365 1.5/1100**: 3HAC079972-001 **IRB 365-1.5/1300**: 3HAC084336-001		L1

Continues on next page

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Removing the telescopic shaft

Use these procedures to remove the telescopic shaft.

Preparations before removing the telescopic shaft

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity. Do not move the position of the upper arms during rotation axis replacement.	
2	**WARNING** Turn off all: • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any loads or tools attached to the tilt arm on the head.	

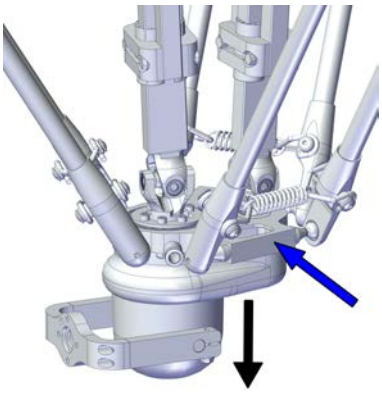
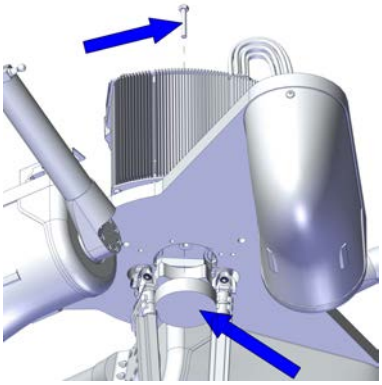
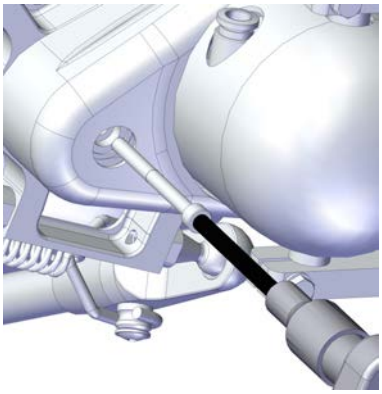
Removing the telescopic shaft

	Action	Note
1	**WARNING** Make sure that all supplies for hydraulic pressure and air pressure are turned off.	

Continues on next page

5.4.3 Replacing the telescopic shafts and shaft components

Continued

	Action	Note
2	Push the brake release button and press the delta plate with head downwards to extend the two telescopic shafts. **Note** Make sure not to over extend the length of telescope shafts due to slide bearing damage	 xx2100000747
3	**WARNING** Turn off all: • electric power supply	
4	Remove the center base cover.	 xx2100000732
5	Remove the attachment screw for telescopic shaft (axis 4).	 xx2100000735

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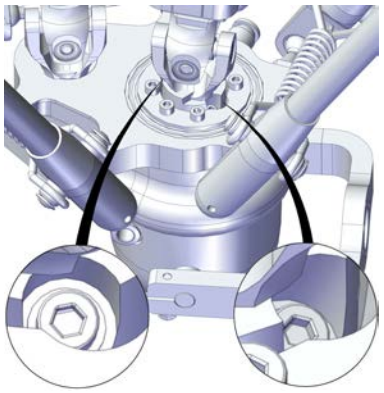
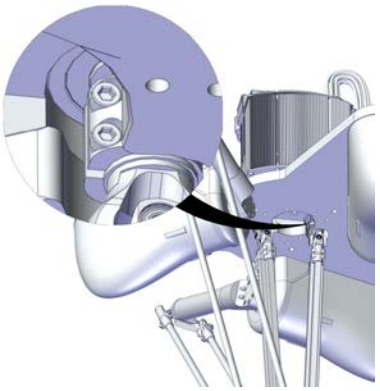
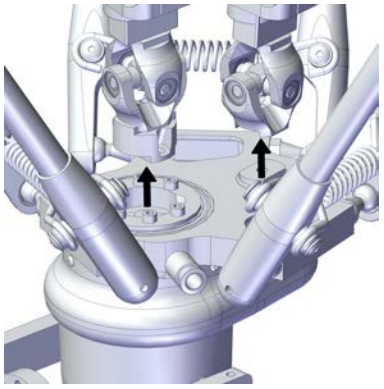
	Action	Note
6	Remove the two attachment screws with washers for telescopic shaft (axis 5).	 xx2100000736
7	Loosen the two attachment screws on the mounting clamp in the upper end of the telescopic shaft.	 xx2100000729
8	Push the telescopic shaft together. **Note** Use light force with mallet if necessary	 xx2100000749

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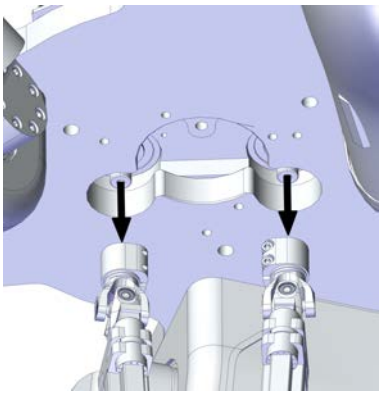
5.4.3 Replacing the telescopic shafts and shaft components
Continued

	Action	Note
9	Remove the telescopic shaft for axes 4 and 5.	 xx2100000733
10	Loosen the attachment screw, and remove the conical connection from the telescopic shaft for axis 5.	 xx2100000751

Refitting the telescopic shaft

Use these procedures to refit the rotation axis.

Refitting the telescopic shaft

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Move the conical connection over to the new telescopic shaft axis 5. Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	Tightening torque: 10 Nm  xx2100000751

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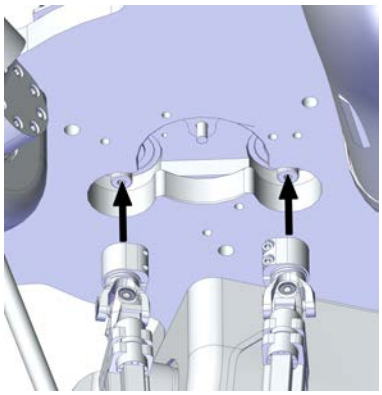
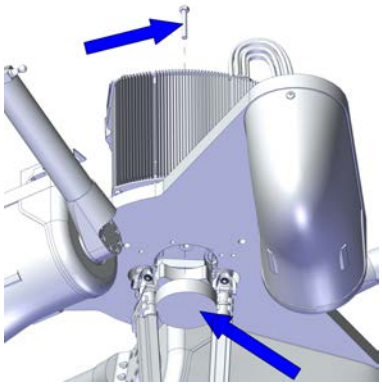
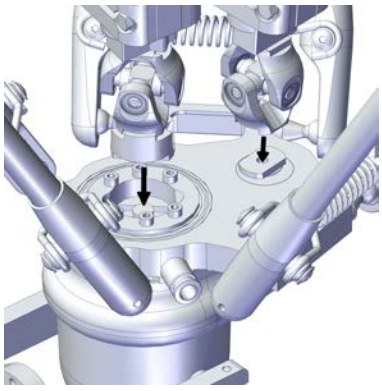
	Action	Note
3	Refit the two telescopic shafts on the motor axis 4 and 5.	 xx2100000750
4	Tighten mounting clamping screws.	Tightening torque: 10 Nm
5	Refit the center base cover.	 xx2100000732
6	Pull out the telescopic shaft and fit the conical coupling into the corresponding coupling on the delta plate Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	10 Nm  xx2100000752

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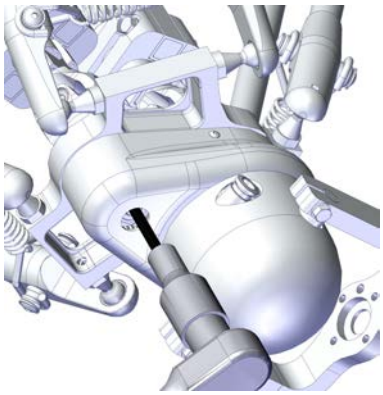
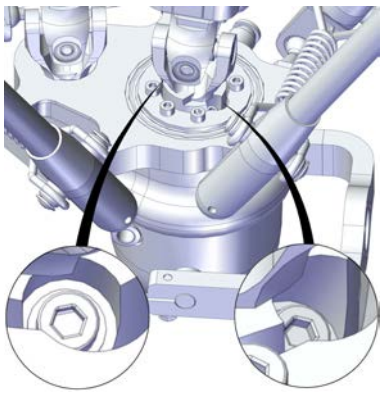
5.4.3 Replacing the telescopic shafts and shaft components

Continued

	Action	Note
7	Refit the attachment screw for telescopic shaft and tighten (axis 4). Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	Tightening torque: 10 Nm  xx2100000748
8	Refit the two attachment screws for telescopic shaft and tighten (axis 5). Add Loctite 638 on the conical surfaces and Loctite 243 on the threads	Tightening torque: 1.6 Nm  xx2100000736
9	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

Concluding procedure

	Action	Note
1	Calibrate the robot.	See *Calibration information on page 191*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

Continues on next page

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Universal joint	3HAC080342-001		L1
Slide bearing	3HAC079975-001		L1

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

Required consumables

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Replacing telescopic shaft parts

The following procedure describes how to disassemble the entire telescopic shaft. The individual components are replaced if they are damaged.

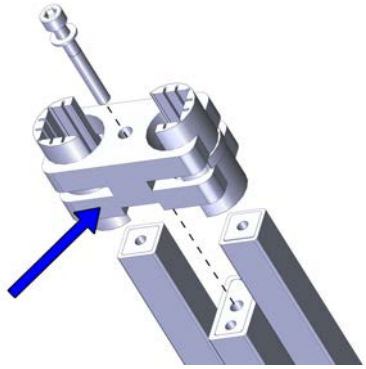
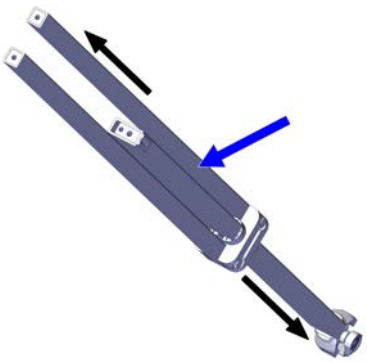
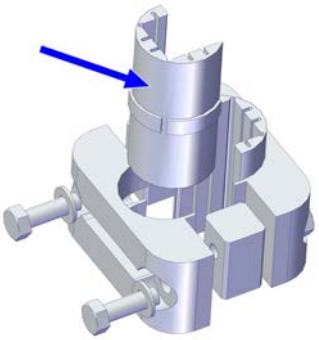
Disassemble the telescopic shaft

	Action	Note
1	Loosen the two attachment screws and remove the universal joint with mounting clamp.	 xx2100000753

Continues on next page

5.4.3 Replacing the telescopic shafts and shaft components

Continued

	Action	Note
2	Remove the attachment screw, and pull off the telescope bearing housing.	 xx2100000754
3	Pull the upper and lower part of the telescopic arm apart.	 xx2100000755
4	Loosen the two attachment screws on the telescope bearing housing, and pull the slide bearing out and replace.	 xx2100000760

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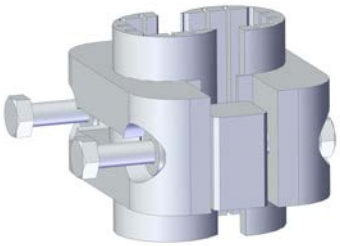
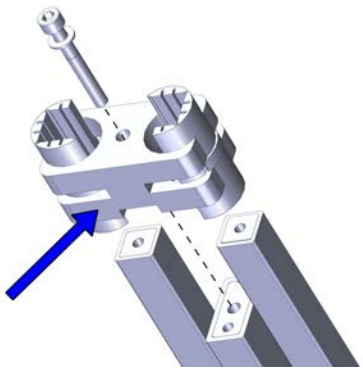
Assembling the telescopic shaft

	Action	Note
1	Add Loctite 243 on the screws. Tighten the two attachment screws on the telescope bearing housing.	Tightening torque: 10 Nm  xx2100000773
2	Push the upper and lower part of the telescopic arm together.	 xx2100000762
3	Add Loctite 243 on the screws. Fit the telescopic bearing housing and tighten the attachment screw.	Tightening torque: 10 Nm  xx2100000754

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5.4.3 Replacing the telescopic shafts and shaft components

Continued

	Action	Note
4	Add Loctite 243 on the screws. Fit the universal joint with mounting clamp to telescopic shaft with the two attachment screws, and tighten.	Tightening torque: 10 Nm  xx2100000753

Concluding procedure

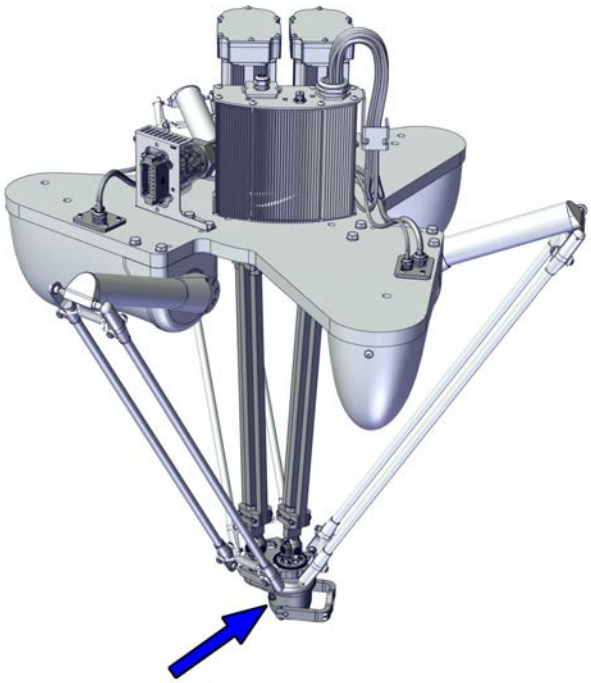
	Action	Note
1	Calibrate the robot.	See *Calibration information on page 191*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.4.4 Replacing the delta unit

Location of the delta unit

The delta unit is located as shown in the figure.

The figure shows a 5-axis IRB 365.



xx2200000124

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Delta unit, with telescope	3HAC080024-001		L1

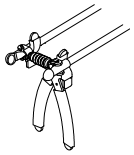
Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Continues on next page

5.4.4 Replacing the delta unit
Continued

Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

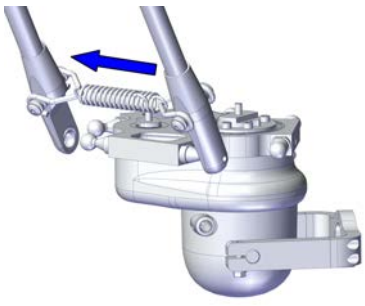
Removing the delta unit

Use these procedures to remove the delta unit.

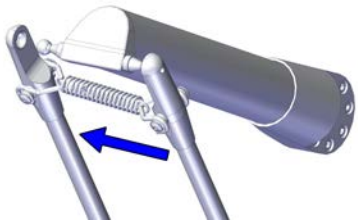
Preparations before removing the delta unit

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity. Do not move the position of the upper arms during parallel arm replacement.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any loads or tools attached to the tilt arm.	

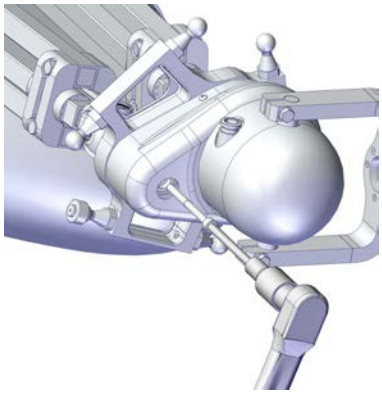
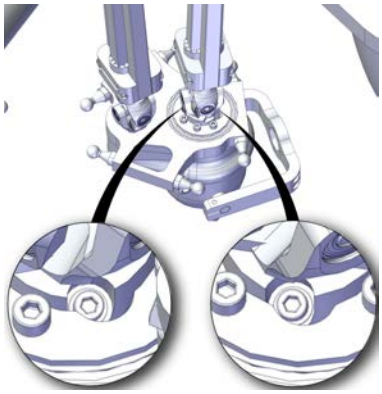
Removing the lower arm

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Remove the lower end of the lower arms from the delta unit by using the pliers, either on the left side or the right side, not both.	 xx2100000722

Continues on next page

	Action	Note
3	Remove the upper end of the lower arms from the upper arms by using the pliers, either on the left side or the right side, not both.	 xx2100000721
4	Remove the lower arms.	

Removing the delta unit

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Place a hand to support the weight of the delta unit from below.	
3	Remove the attachment screw for telescopic shaft (axis 4).	 xx2200000208
4	Remove the two attachment screws with washers for telescopic shaft (axis 5).	 xx2100000770

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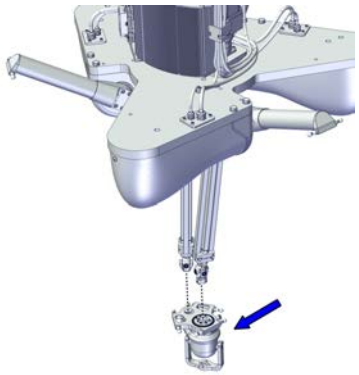
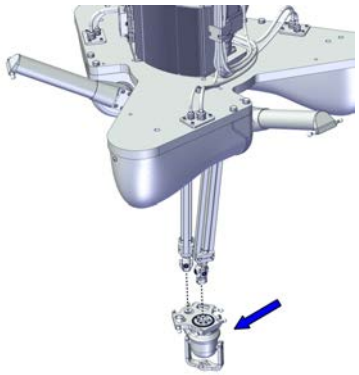
5.4.4 Replacing the delta unit
Continued

	Action	Note
5	Remove the delta unit from the telescopic shafts. **Note** Use light force with mallet if necessary.	 xx2200000206

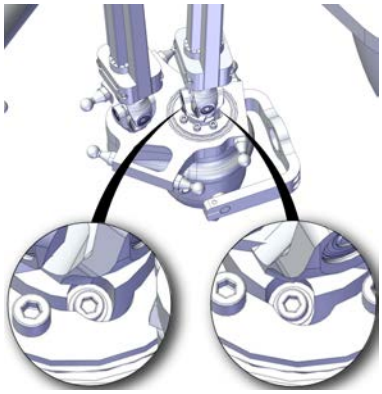
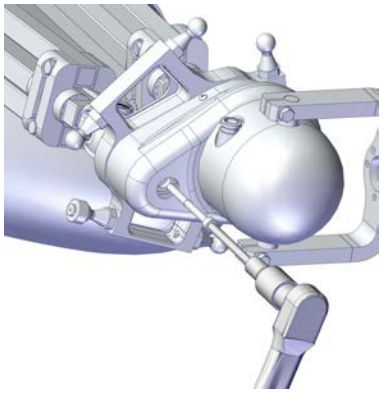
Refitting the delta unit

Use these procedures to refit the delta unit.

Refitting the delta unit

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Refit delta unit to the telescopic shafts for axis four and axis five.	 xx2200000206

Continues on next page

	Action	Note
3	**Note** Make sure that the telescopic shaft is mounted between the motor shaft 4 and the attachment point for telescopic shaft axis 4 on the delta unit. **Note** Do not tighten the mounting clamps screws before refitting the parallel arms.	 xx2100000772
4	Refit the two attachment screws with washers for telescopic shaft (axis 5).	Tightening torque: 1.6 Nm  xx2100000770
5	Apply locking liquid, and tighten the attachment screw axis 4.	Tightening torque: 10 Nm  xx2200000208

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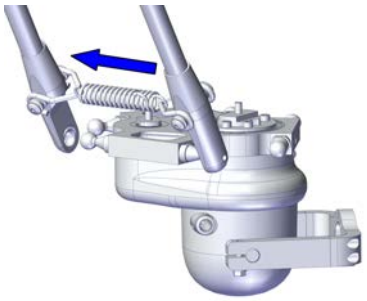
5.4.4 Replacing the delta unit

Continued

	Action	Note
6	Fit the lower arms to the delta unit by using the pliers, either on the left side or the right side, not both.	 xx2100000722

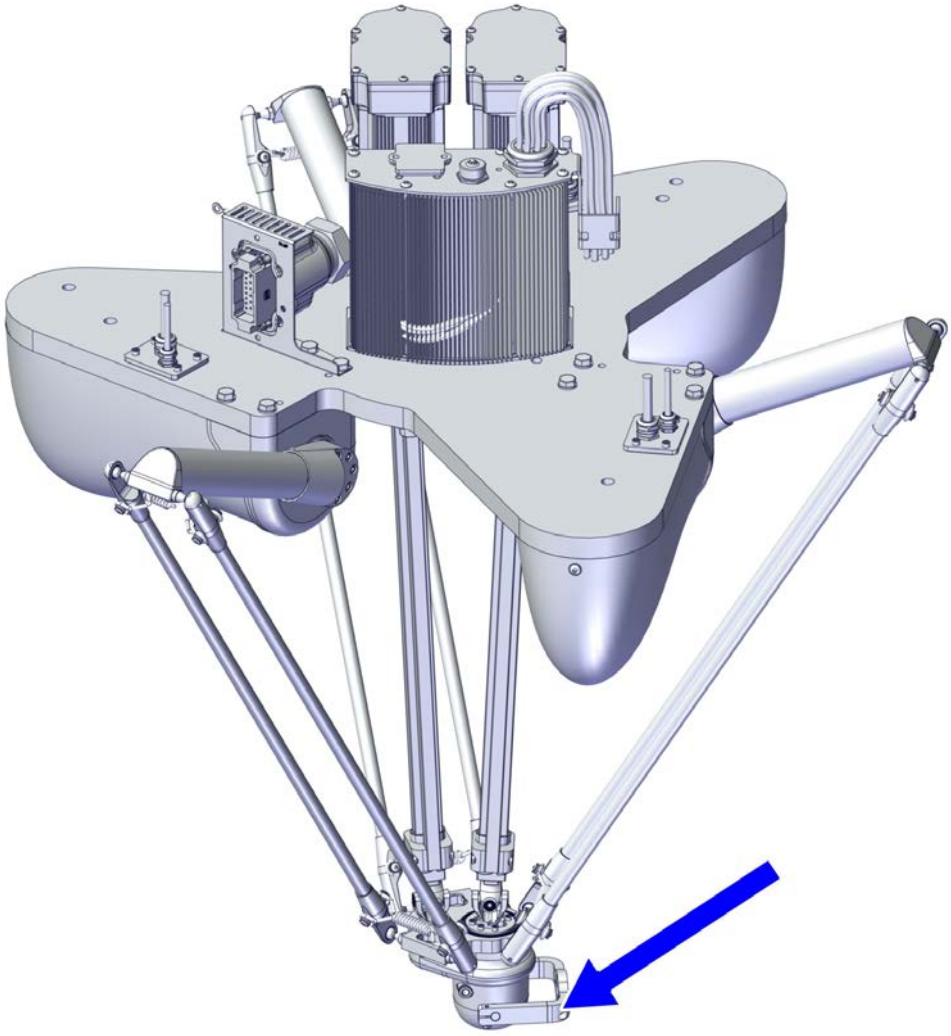
Concluding procedure

	Action	Note
1	Calibrate the robot.	See *Calibration information on page 191*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.4.5 Replacing the tilt arm

Location of the tilt arm

The tilt arm is located as shown in the figure.



xx2100000774

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note	Level
Tilt arm stool	3HAC079970-001		L2
Tilt arm parts	3HAC079969-001		L2

Continues on next page

5.4.5 Replacing the tilt arm
Continued

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

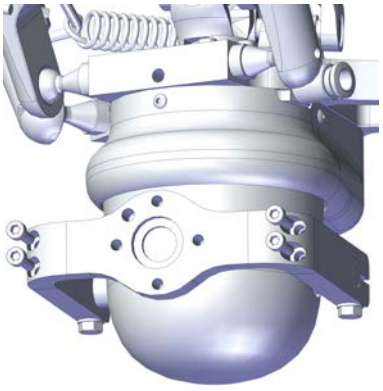
Removing the tilt arm

Use these procedures to remove the tilt arm.

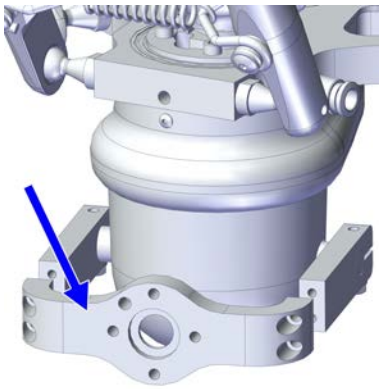
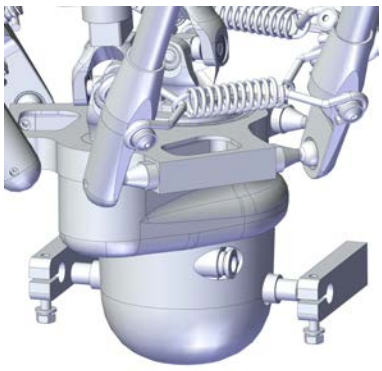
Preparations before removing the tilt arm

	Action	Note
1	Jog the robot to an appropriate working position.	
2	**DANGER** Turn off all: • electric power supply • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	

Removing the tilt arm

	Action	Note
1	**CAUTION** Make sure that all supplies for electrical power are turned off.	
2	Remove the tilt stool attachment screws.	 xx2100000776

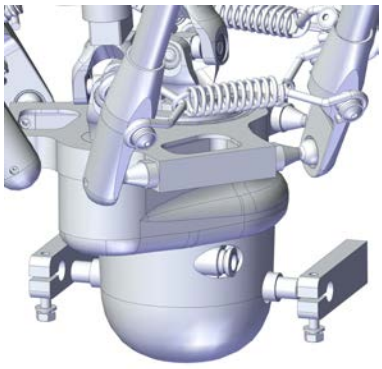
Continues on next page

	Action	Note
3	Remove the tilt stool.	 xx2100000777
4	Loosen the attachment screws, and remove the tilt arm parts from the through shaft.	 xx2100000778

Refitting the tilt arm

Use these procedures to refit the tilt arm.

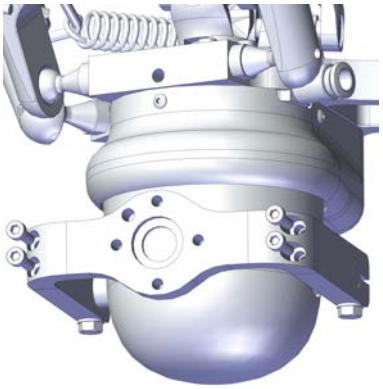
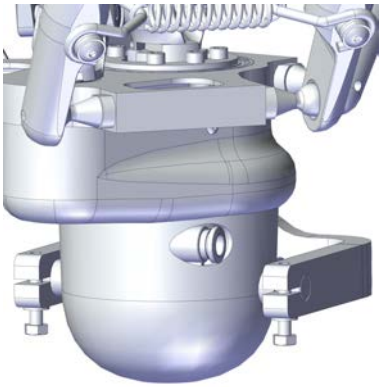
Refitting the tilt arm

	Action	Note
1	Fit the both tilt arm parts on the through shaft.	 xx2100000778

Continues on next page

5.4.5 Replacing the tilt arm

Continued

	Action	Note
2	Add Loctite 243 to all screws. Fit the tilt stool to the tilt arm parts, and tighten the attachment screws.	Tightening torque: 3.5 Nm.  xx2100000776
3	Add Loctite 243 to all screws. Tighten the tilt arm part attachment screws.	Tightening torque: 7 Nm.  xx2100000780

Concluding procedure

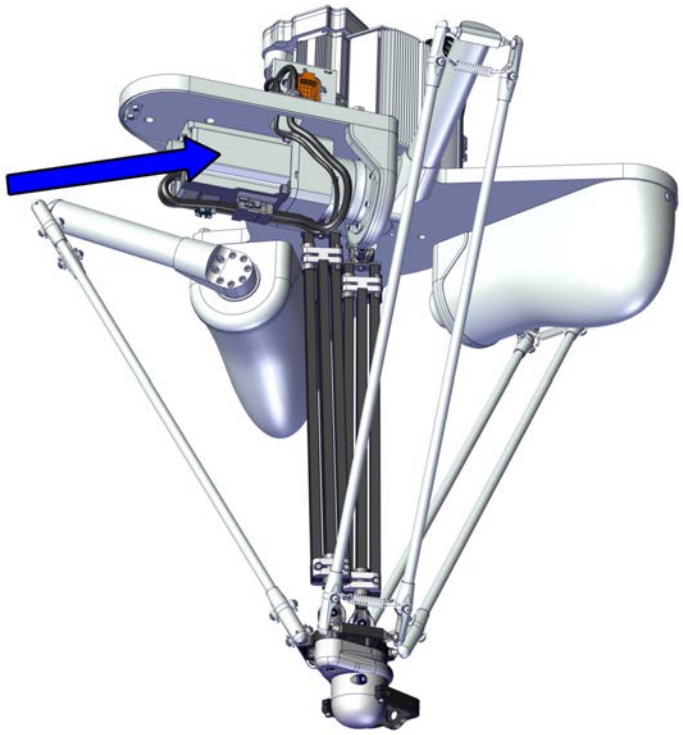
	Action	Note
1	Calibrate the robot.	See *Calibration information on page 191*.
2	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.5 Motors and gears

5.5.1 Replacing the axis-1, axis 2 and axis-3 motor

Location of the motor

The motor is located as shown in the figure.



xx2100000966

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

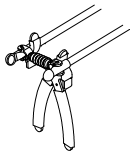
Spare part	Article number	Note
Rot AC Motor M105.1 w. adapter	3HAC079982-001	

Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	

Continues on next page

5.5.1 Replacing the axis-1, axis 2 and axis-3 motor
Continued

Equipment	Article number	Note	Image
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Removing the motor

Use these procedures to remove the motor.

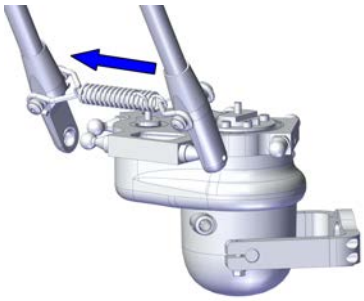
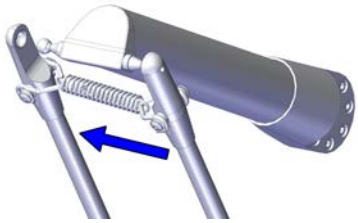
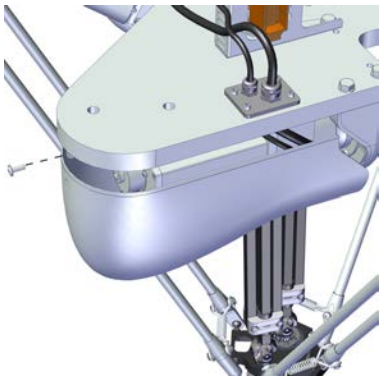
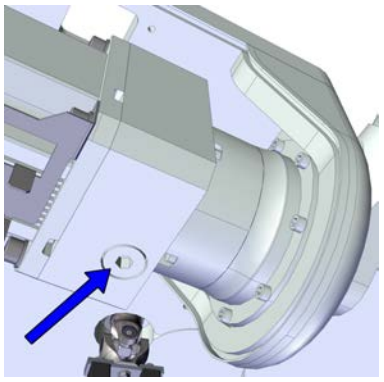
Preparations before removing the motor

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity.	
2	**WARNING** Turn off all: • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any loads or tools attached to the tilt arm on the head.	

Removing the motor

	Action	Note
1	**WARNING** Make sure that all supplies for hydraulic pressure and air pressure are turned off.	
2	**WARNING** To secure no accidental movement and engagement of drive power, set robot into manual mode and also engage the emergency stop on the FlexPendant.	

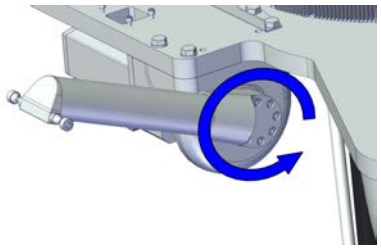
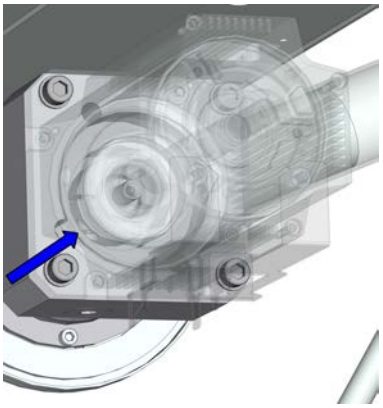
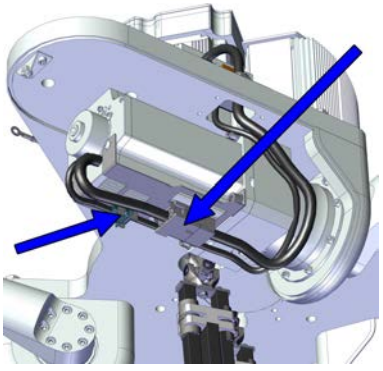
Continues on next page

	Action	Note
3	Remove the lower end of the lower arms from the delta unit by using the pliers, either on the left side or the right side, not both.	 xx2100000722
4	Remove the upper end of the lower arms from the upper arm by using the pliers, either on the left side or the right side, not both.	 xx2100000721
5	Remove the parallel arms.	
6	Remove motor cover and screw.	 xx2100000725
7	Remove the protection plug in adapter plate.	 xx2100000969
8	Look into the hole in adapter plate.	

Continues on next page

5.5.1 Replacing the axis-1, axis 2 and axis-3 motor

Continued

	Action	Note
9	Push the brake release button to release upper arm. Rotate upper arm to align the hex cap screw to the hole in adapter plate.	 xx2100002381
10	Loosen the hex cap screw for motor shaft.	 xx2100002382
11	**WARNING** Turn off all: • electric power supply	
12	Disconnect the two cable connectors on motor.	 xx2100000967

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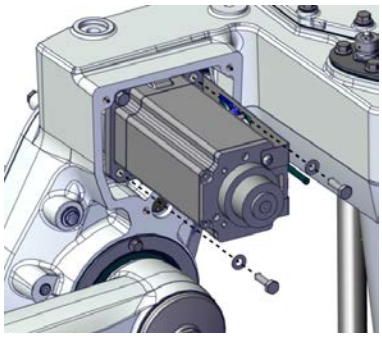
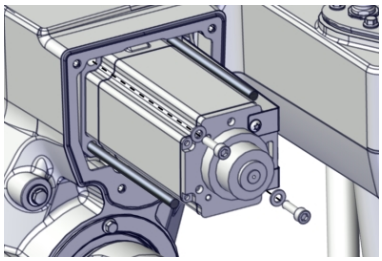
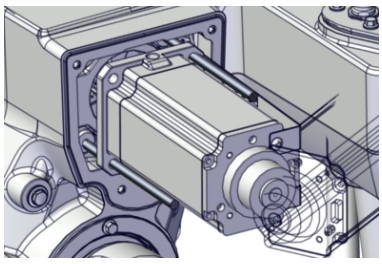
	Action	Note
13	Remove two of the screws and washers securing the motor.	 xx1900000760
14	Fasten two guide pins. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	 xx1900001835
15	Remove the two remaining screws and washers.	
16	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
17	Remove the motor including the bracket by sliding it out on the guide pins and lift it off.	 xx1900001834

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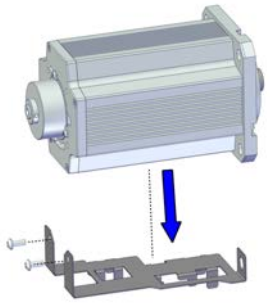
5.5.1 Replacing the axis-1, axis 2 and axis-3 motor
Continued

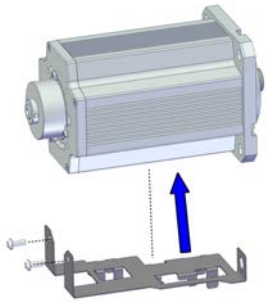
Removing the bracket from the motor

Removing bracket

	Action	Note
1	Loosen the two screws in the front.	 xx2100002680

Refitting the bracket on the motor

Refitting bracket

	Action	Note
1	Refit the two attachment screws in the front.	Tightening torque: 12 Nm  xx2100002681

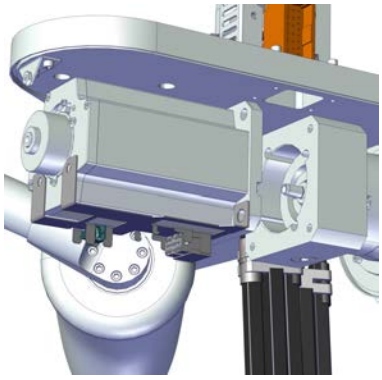
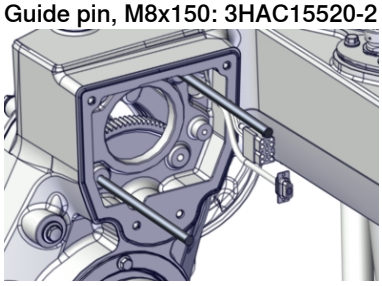
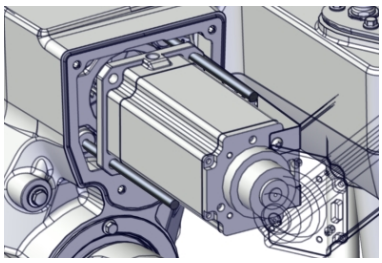
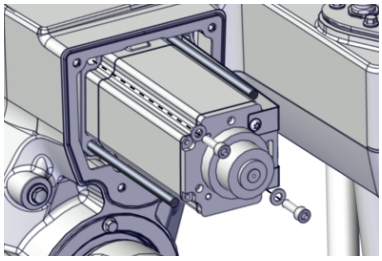
Refitting the motor

Use these procedures to refit the motor axis-1-3

Refitting the motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

	Action	Note
2	**Note** Clean the mating surface with isopropanol.	
3	Refit the motor including the bracket.	 xx2100000970
4	If not already fitted, fasten two guide pins to opposite screw holes. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M8x150: 3HAC15520-2  xx1900001836
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear. **Note** Clean the mating surface with isopropanol.	 xx1900001834
7	Fit the attachment screws and washers. Tighten by hand. Do not tighten with a torque yet.	 xx1900001835

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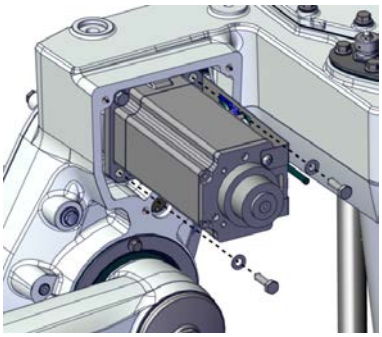
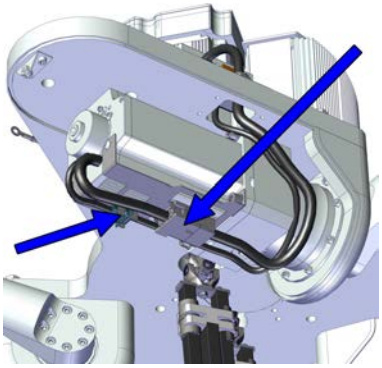
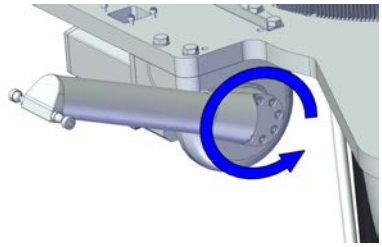
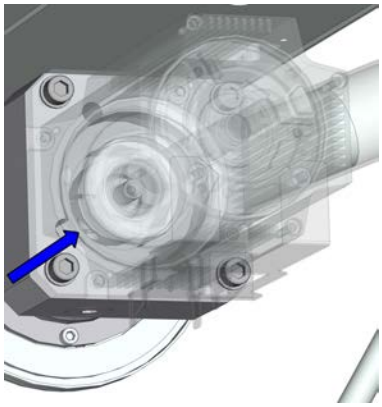
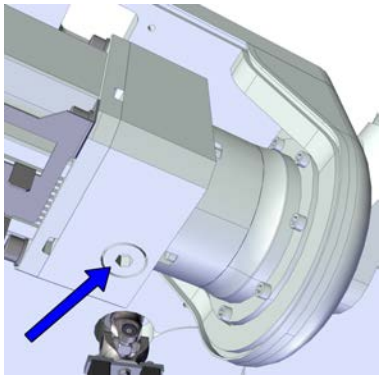
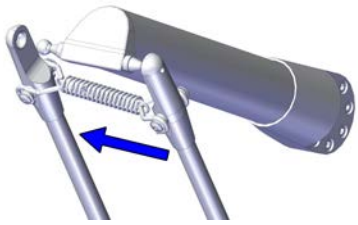
5.5.1 Replacing the axis-1, axis 2 and axis-3 motor

Continued

	Action	Note
8	Remove the guide pins and fit the remaining two screws and washers. Tighten by hand. Do not tighten with a torque yet.	 xx1900000760
9	Add Loctite 243 to all screws. Tighten the four motor attachment screws.	Tightening torque: 17 Nm
10	Connect the two cable connectors on motor.	 xx2100000967
11	**WARNING** Turn on all: • electric power supply	
12	Rotate upper arm to align the mounting clamp hole with the adapter plate. If needed push the brake release button to release upper arm.	 xx2100002381

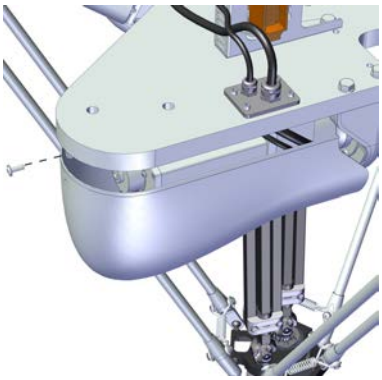
Continues on next page

	Action	Note
13	Refit the hex cap screw and tighten the mounting clamp for motor shaft. See tightening torque on the mounting clamp.	Tightening torque: 14 Nm  xx2100002382
14	Refit the protection plug in adapter plate.	 xx2100000969
15	Refit the lower arms to the upper arms by using the pliers, either on the left side or the right side, not both. **Note** Be careful not to damage the ball bearing cups.	 xx2100000721
16	Repeat the procedure in the lower end of the lower arms, on the delta unit.	

Continues on next page

5.5.1 Replacing the axis-1, axis 2 and axis-3 motor

Continued

	Action	Note
17	Refit the motor cover including the gasket and tighten the attachment screw.	Tightening torque: 2 Nm  xx2100000725

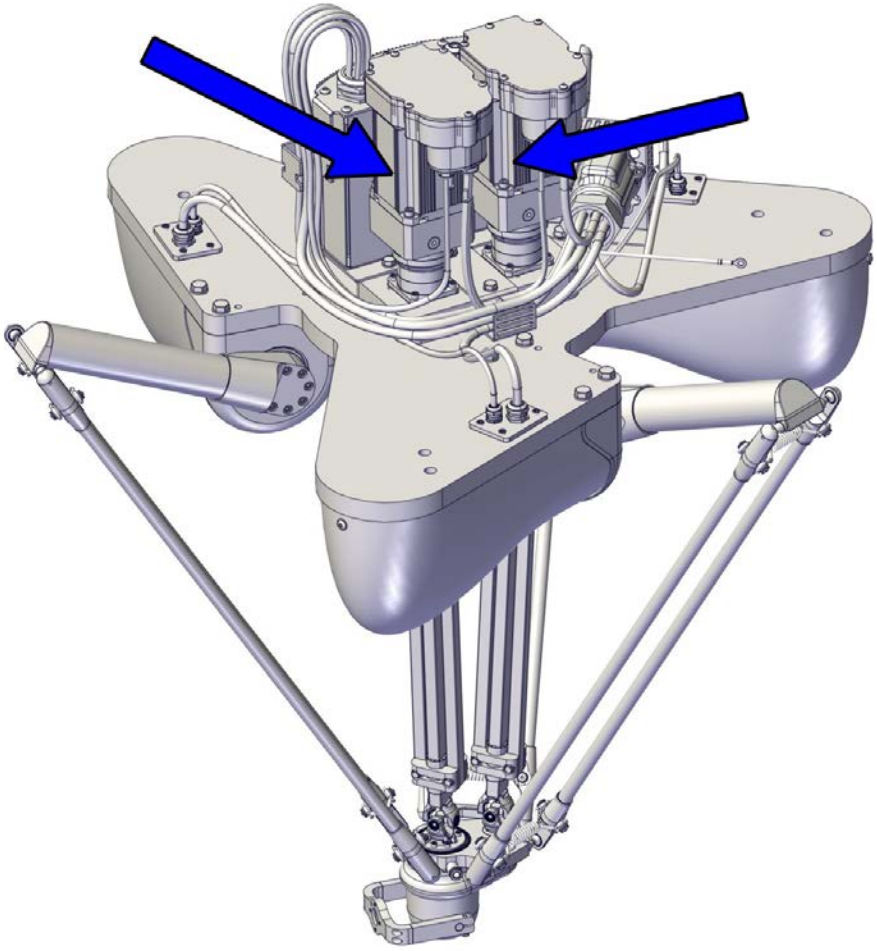
Concluding procedure

	Action	Note
1	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
2	Calibrate the robot.	See *Calibration information on page 191*.
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.5.2 Replacing the axis-4 and axis-5 motor

Location of the motor

The motor is located as shown in the figure.



xx2100001425

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Rot AC motor M104 w. adapter	3HAC078682-001	

Continues on next page

5.5.2 Replacing the axis-4 and axis-5 motor
Continued

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Removing the motor

Use these procedures to remove the motor axis 4 and 5.

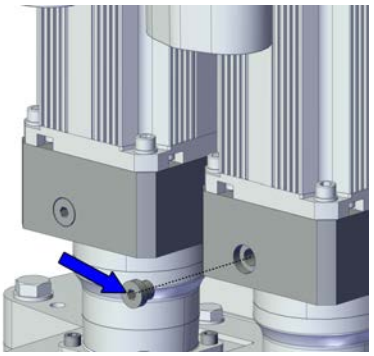
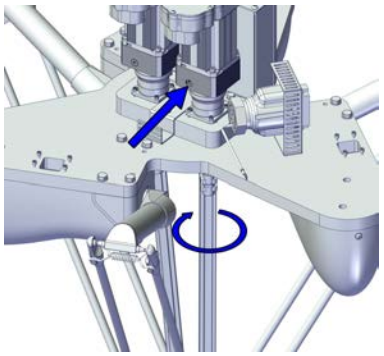
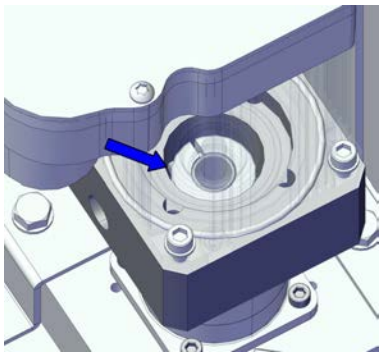
Preparations before removing the motor

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity.	
2	**WARNING** Turn off all: • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any loads or tools attached to the tilt arm on the head.	

Removing the motor

	Action	Note
1	**WARNING** Turn off all: • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** To secure no accidental movement and engagement of drive power, set robot into manual mode and also engage the emergency stop on the FlexPendant.	

Continues on next page

	Action	Note
3	Remove the protection plug in adapter plate.	 xx2100002706
4	Rotate telescopic arm to align the hex cap screw to the hole in adapter plate. Push the brake release button to release telescopic arm.	 xx2100002687
5	**WARNING** Turn off all: • electric power supply	
6	Loosen the hex cap screw for motor shaft.	 xx2100002688

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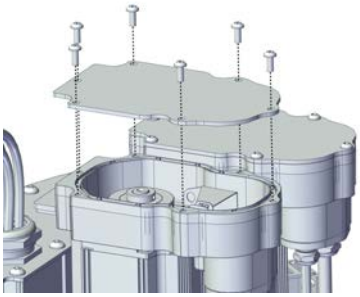
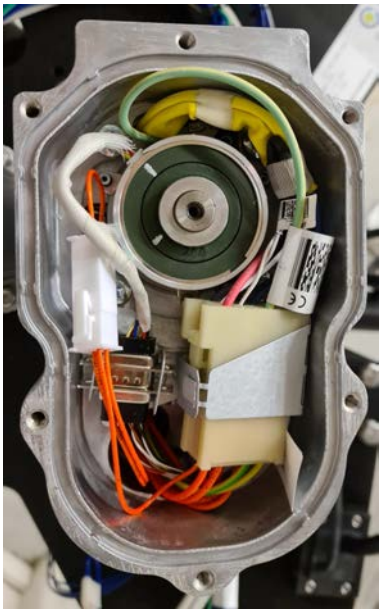
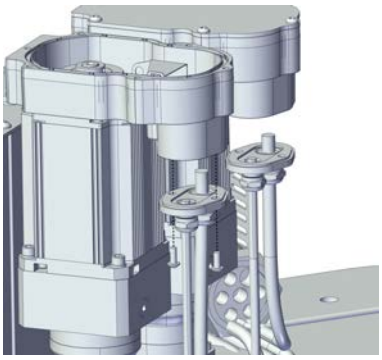
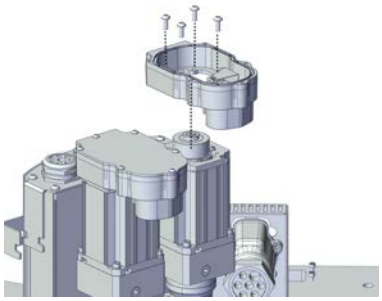
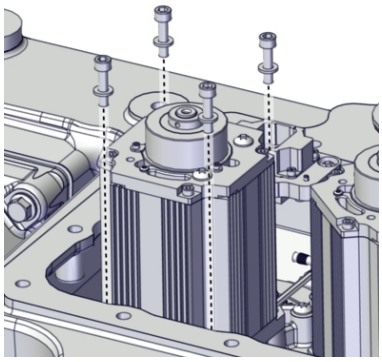
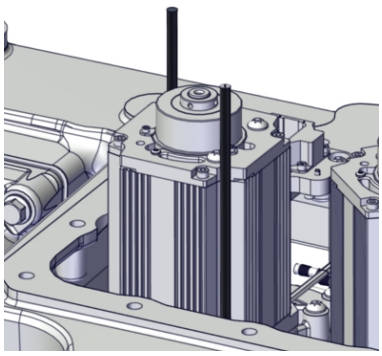
5.5.2 Replacing the axis-4 and axis-5 motor

Continued

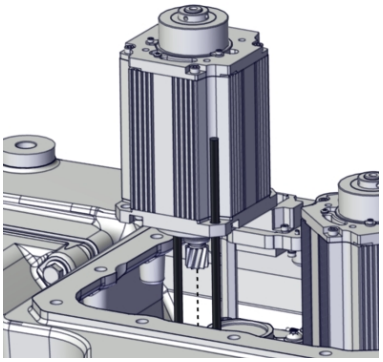
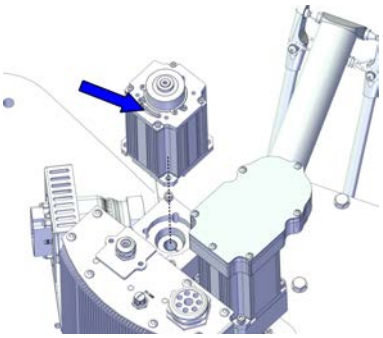
	Action	Note
7	Remove M5-screws and motor cover.	 xx2100001418
8	Disconnect the white connector and the yellow connector on the motor top.	 xx2200000212
9	Remove the two screws and remove the cover with cable glands.	 xx2100001419

Continues on next page

	Action	Note
10	Remove the M6-screws and the connection box. Clean the contact surface on connection box with isopropanol. Use a lint-free cloth.	 xx2100002700
11	Remove the four attachment screws with washers.	 xx2000001082
12	Fit guide pins in opposite holes.	 xx2000001084
13	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

5.5.2 Replacing the axis-4 and axis-5 motor
Continued

	Action	Note
14	Use caution and lift the motor straight up to get the pinion parted from the gear.	 xx2000001083
15	Remove the motor.	 xx2100001422

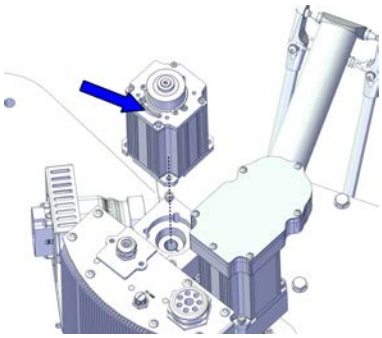
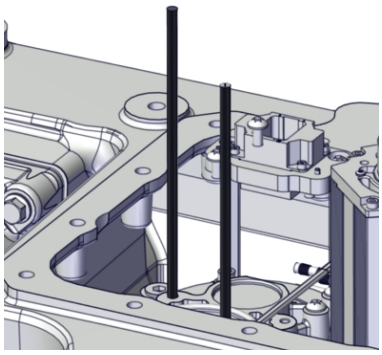
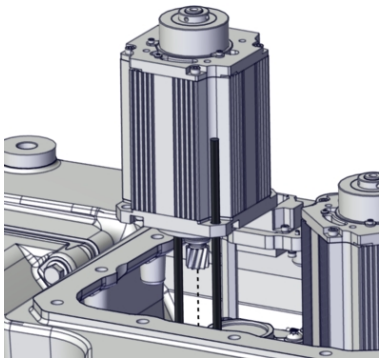
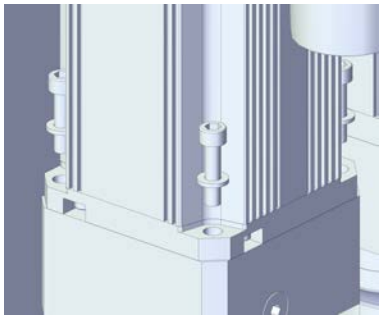
Refitting the motor

Use these procedures to refit the motor axis 4 and 5.

Refitting the motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**Note** Clean the mating surface with isopropanol.	

Continues on next page

	Action	Note
3	Refit the motor. The recess on the top of the motor must be opposite oriented from protection plug at the adapter.	 xx2100001422
4	If not already fitted, fit two guide pins to the motor attachment holes.	 xx2000001088
5	Lift the motor into the base. **Note** Clean the mating surface with isopropanol.	 xx2000001083
6	Add Loctite 243 to all screws. Secure the unit with attachment screws and washers.	Tightening torque: 7 Nm  xx2100001421

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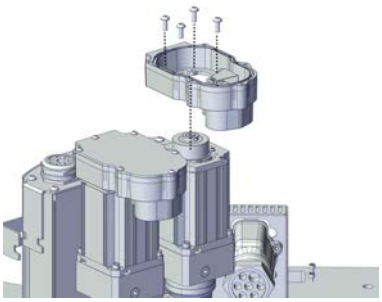
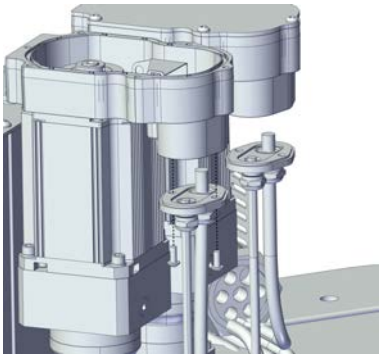
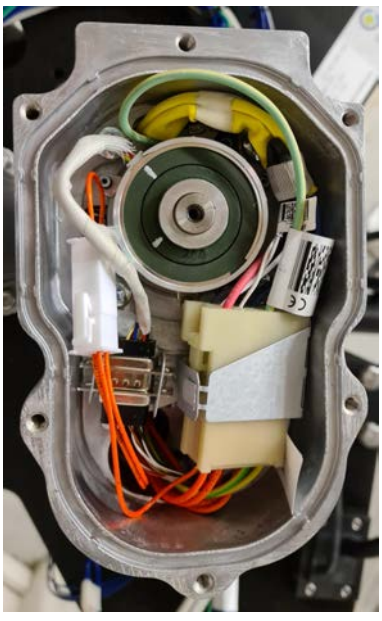
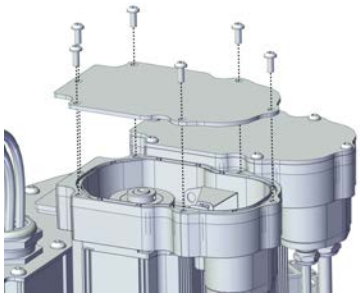
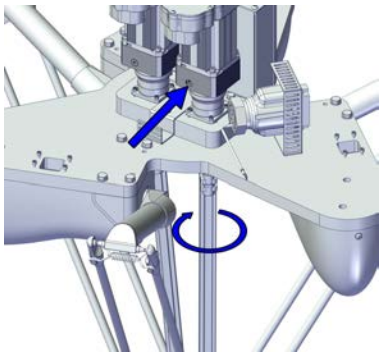
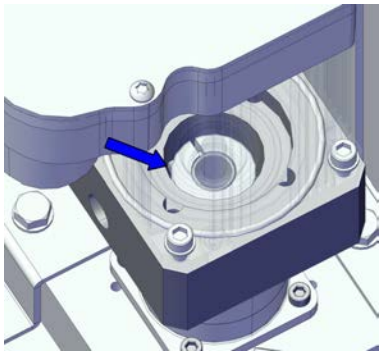
5.5.2 Replacing the axis-4 and axis-5 motor
Continued

	Action	Note
7	Clean with isopropanol.	
8	Add transclear into the groove for the o-ring.	
9	Refit connection box and the M6-screws.	Tightening torque: 12 Nm  xx2100002700
10	Refit the cover with cable glands and the two M5-screws.	3.5 Nm  xx2100001419
11	Connect the white connector and the yellow connector. The cables must not interfere movement parts.	 xx2200000212

Continues on next page

	Action	Note
12	Refit the motor cover and M5-screws.	Tightening torque: 6 Nm  xx2100001418
13	**WARNING** Turn on all: • electric power supply	
14	Rotate telescopic arm to align the hex cap screw to the hole in adapter plate. If needed push the brake release button to release telescopic arm.	 xx2100002687
15	Refit the hex cap screw and tighten the mounting clamp for motor shaft. See tightening torque on the mounting clamp.	Tightening torque: 9.5 Nm  xx2100002688

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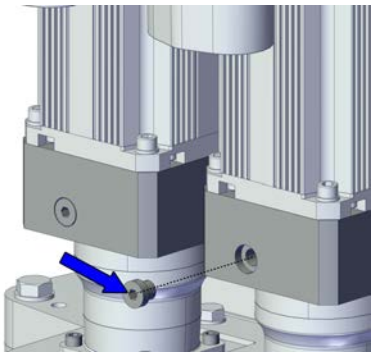
5.5.2 Replacing the axis-4 and axis-5 motor

Continued

	Action	Note
16	Refit the protection plug in adapter plate.	 xx2100002706

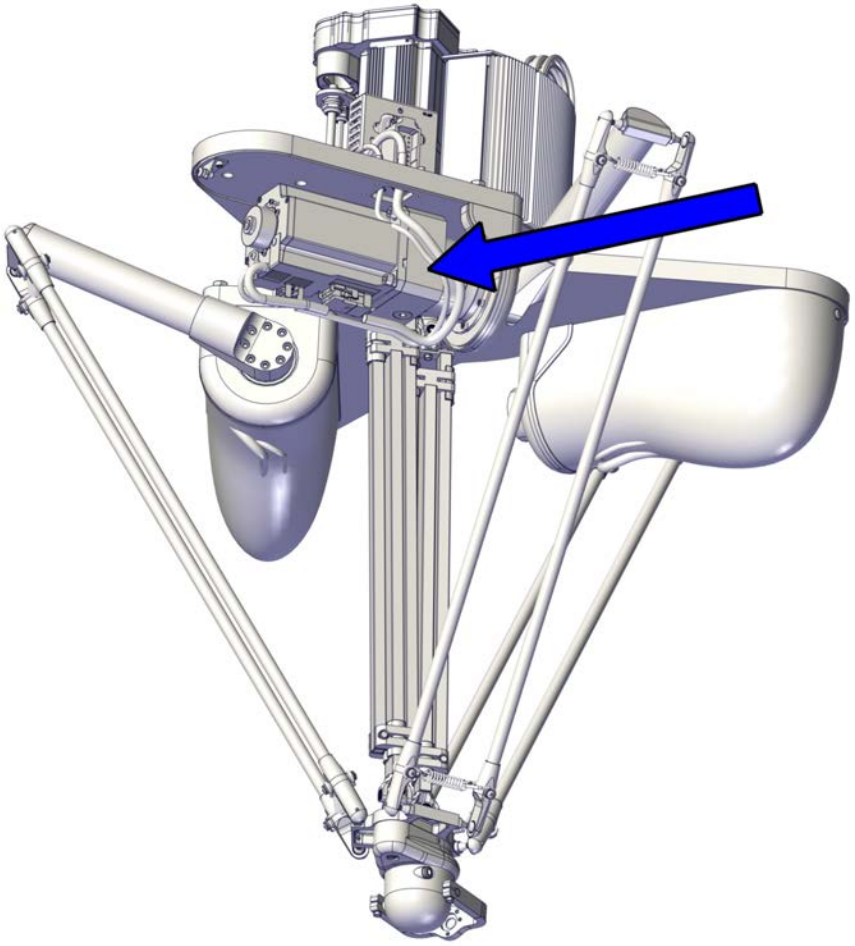
Concluding procedure

	Action	Note
1	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
2	Calibrate the robot.	See *Calibration information on page 191*.
3	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.5.3 Replacing the axis-1, axis 2 and axis-3 gear unit

Location of the gear unit

The gearbox is located as shown in the figure.



xx2100001427

Required spare parts

Note

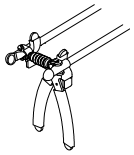
The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Gear unit	3HAC080023-001	

Continues on next page

5.5.3 Replacing the axis-1, axis 2 and axis-3 gear unit
Continued

Required tools and equipment

Equipment	Article number	Note	Image
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.	
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

Removing the gear unit

Use these procedures to remove the gear unit.

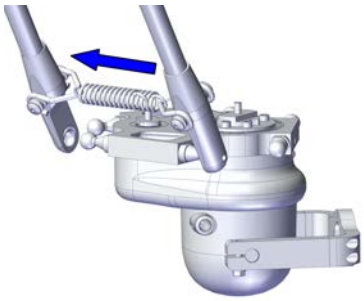
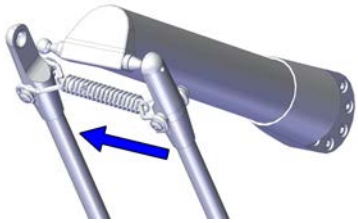
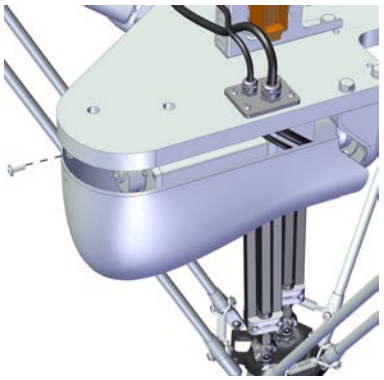
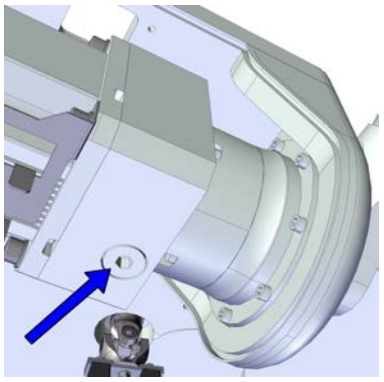
Preparations before removing the motor

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity.	
2	**WARNING** Turn off all: • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any loads or tools attached to the tilt arm on the head.	

Removing the motor

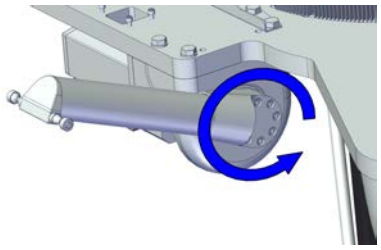
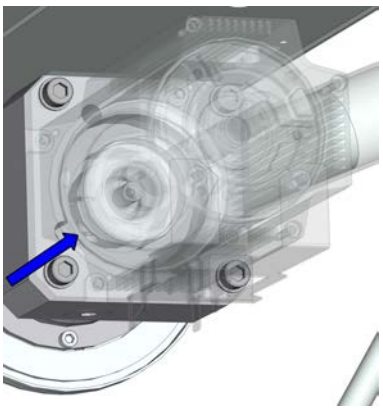
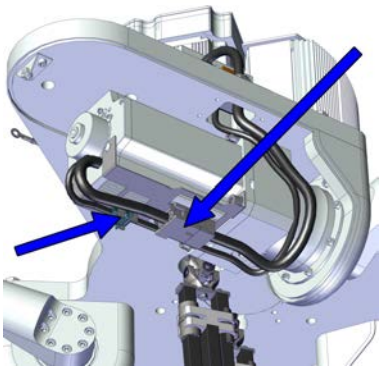
	Action	Note
1	**WARNING** Make sure that all supplies for hydraulic pressure and air pressure are turned off.	
2	**WARNING** To secure no accidental movement and engagement of drive power, set robot into manual mode and also engage the emergency stop on the FlexPendant.	

Continues on next page

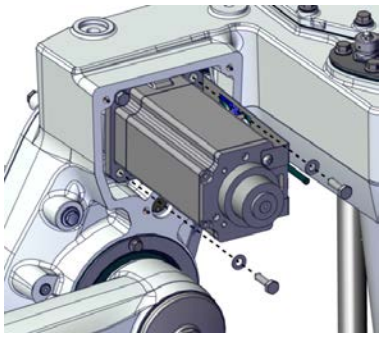
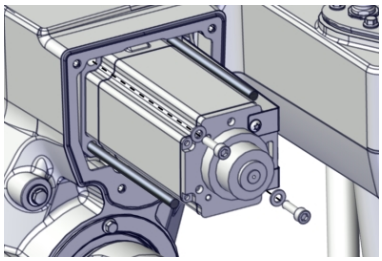
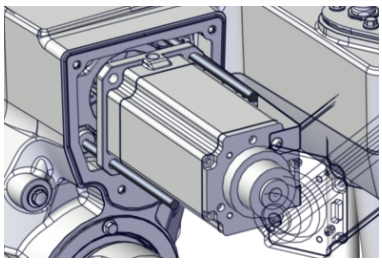
	Action	Note
3	Remove the lower end of the lower arms from the delta unit by using the pliers, either on the left side or the right side, not both.	 xx2100000722
4	Remove the upper end of the lower arms from the upper arm by using the pliers, either on the left side or the right side, not both.	 xx2100000721
5	Remove the parallel arms.	
6	Remove motor cover and screw.	 xx2100000725
7	Remove the protection plug in adapter plate.	 xx2100000969
8	Look into the hole in adapter plate.	

Continues on next page

5.5.3 Replacing the axis-1, axis 2 and axis-3 gear unit
Continued

	Action	Note
9	Push the brake release button to release upper arm. Rotate upper arm to align the hex cap screw to the hole in adapter plate.	 xx2100002381
10	Loosen the hex cap screw for motor shaft.	 xx2100002382
11	**WARNING** Turn off all: • electric power supply	
12	Disconnect the two cable connectors on motor.	 xx2100000967

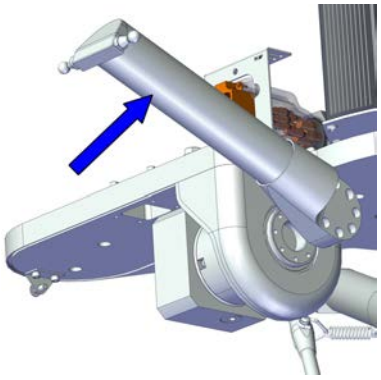
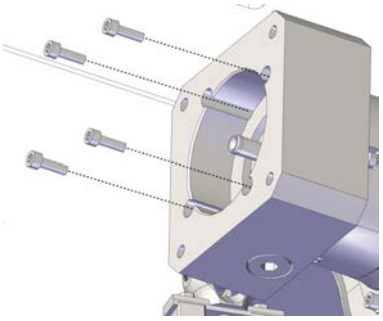
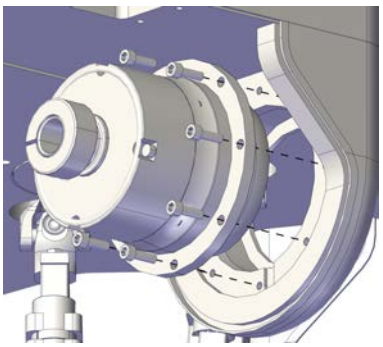
Continues on next page

	Action	Note
13	Remove two of the screws and washers securing the motor.	 xx1900000760
14	Fasten two guide pins. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	 xx1900001835
15	Remove the two remaining screws and washers.	
16	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
17	Remove the motor including the bracket by sliding it out on the guide pins and lift it off.	 xx1900001834

Continues on next page

5.5.3 Replacing the axis-1, axis 2 and axis-3 gear unit
Continued

Removing the gear unit

	Action	Note
1	Remove the upper arm from the base unit	 xx2100002500
2	Remove the four attachment screws with washers and remove the adapter plate.	 xx2100001428
3	Remove the eight attachment screws with washers and remove the gear unit.	 xx2100001701

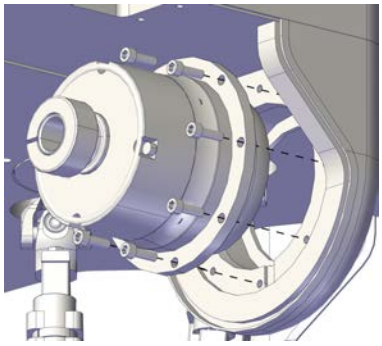
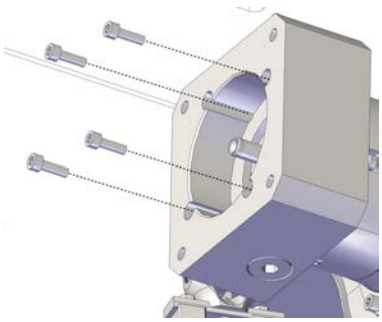
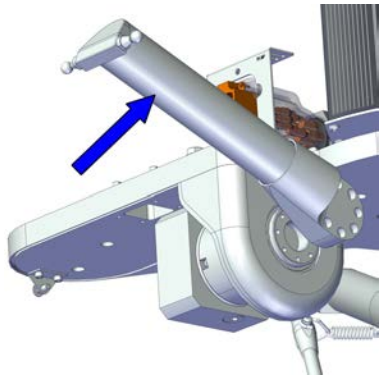
Refitting the gear unit

Use these procedures to refit the gear unit.

Refitting the gear unit

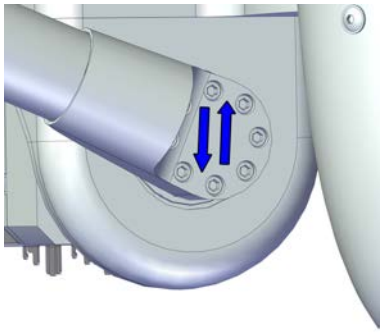
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	

Continues on next page

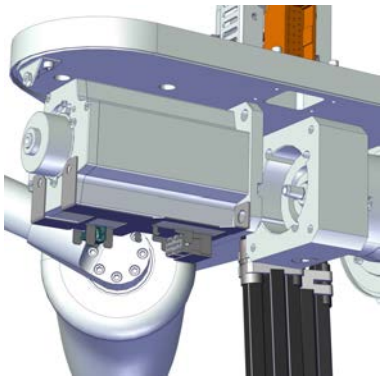
	Action	Note
2	Add Loctite 243 to the eight attachment screws.	
3	Refit the gear unit and tighten the eight attachment screws with washers.	Tightening torque: 7 Nm  xx2100001701
4	Add Loctite 243 to the four attachment screws.	
5	Refit the adapter plate and tighten the four attachment screws with washers.	Tightening torque: 4.55 Nm  xx2100001428
6	Fit the upper arm to the base unit.	 xx2100002500

Continues on next page

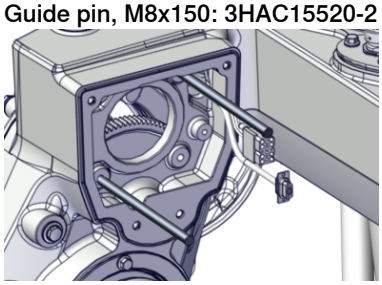
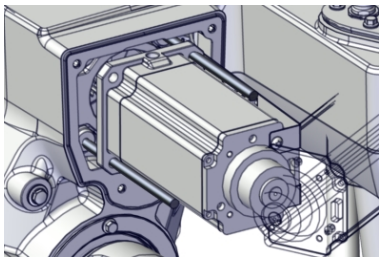
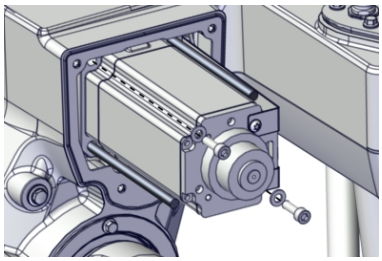
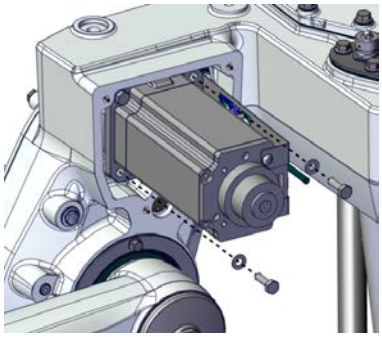
5.5.3 Replacing the axis-1, axis 2 and axis-3 gear unit
Continued

	Action	Note
7	Add Loctite 243 to the four attachment screws. Refit the eight attachment screws opposite each other.	Tightening torque: 16 Nm.  xx2100002383

Refitting the motor

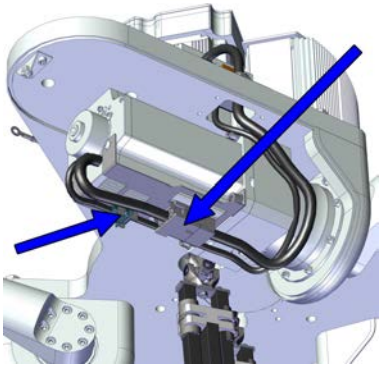
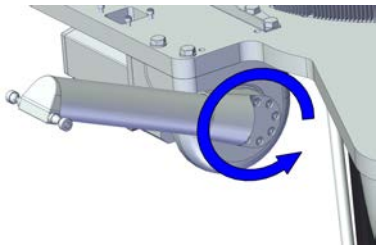
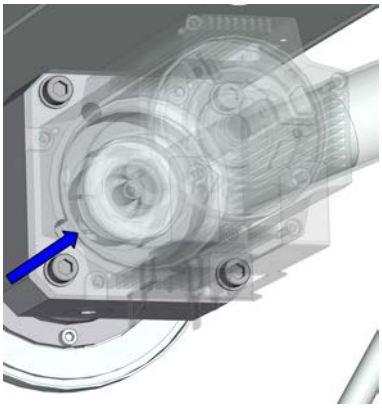
	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**Note** Clean the mating surface with isopropanol.	
3	Refit the motor including the bracket.	 xx2100000970

Continues on next page

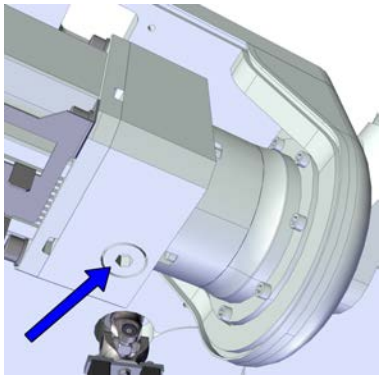
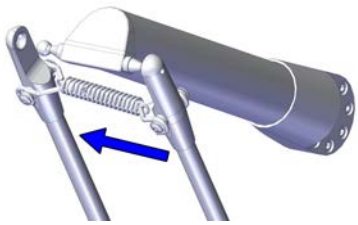
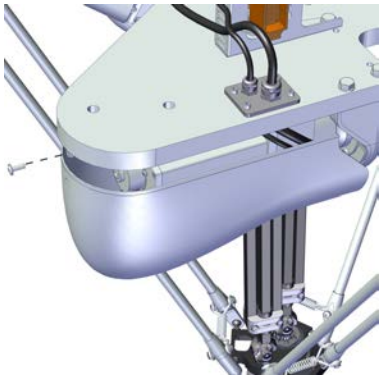
	Action	Note
4	If not already fitted, fasten two guide pins to opposite screw holes. **Tip** Lubricate the guide pins with some grease to make the motor slide better.	Guide pin, M8x150: 3HAC15520-2  xx1900001836
5	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
6	Lift the motor and put it on the guide pins as close as possible to its final position without pushing the motor pinion into the gear. **Note** Clean the mating surface with isopropanol.	 xx1900001834
7	Fit the attachment screws and washers. Tighten by hand. Do not tighten with a torque yet.	 xx1900001835
8	Remove the guide pins and fit the remaining two screws and washers. Tighten by hand. Do not tighten with a torque yet.	 xx1900000760
9	Add Loctite 243 to all screws. Tighten the four motor attachment screws.	Tightening torque: 17 Nm

Continues on next page

5.5.3 Replacing the axis-1, axis 2 and axis-3 gear unit
Continued

	Action	Note
10	Connect the two cable connectors on motor.	 xx2100000967
11	**WARNING** Turn on all: • electric power supply	
12	Rotate upper arm to align the mounting clamp hole with the adapter plate. If needed push the brake release button to release upper arm.	 xx2100002381
13	Refit the hex cap screw and tighten the mounting clamp for motor shaft. See tightening torque on the mounting clamp.	Tightening torque: 14 Nm  xx2100002382

Continues on next page

	Action	Note
14	Refit the protection plug in adapter plate.	 xx2100000969
15	Refit the lower arms to the upper arms by using the pliers, either on the left side or the right side, not both. **Note** Be careful not to damage the ball bearing cups.	 xx2100000721
16	Repeat the procedure in the lower end of the lower arms, on the delta unit.	
17	Refit the motor cover including the gasket and tighten the attachment screw.	Tightening torque: 2 Nm  xx2100000725

Concluding procedure

	Action	Note
1	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
2	Calibrate the robot.	See *Calibration information on page 191*.

Continues on next page

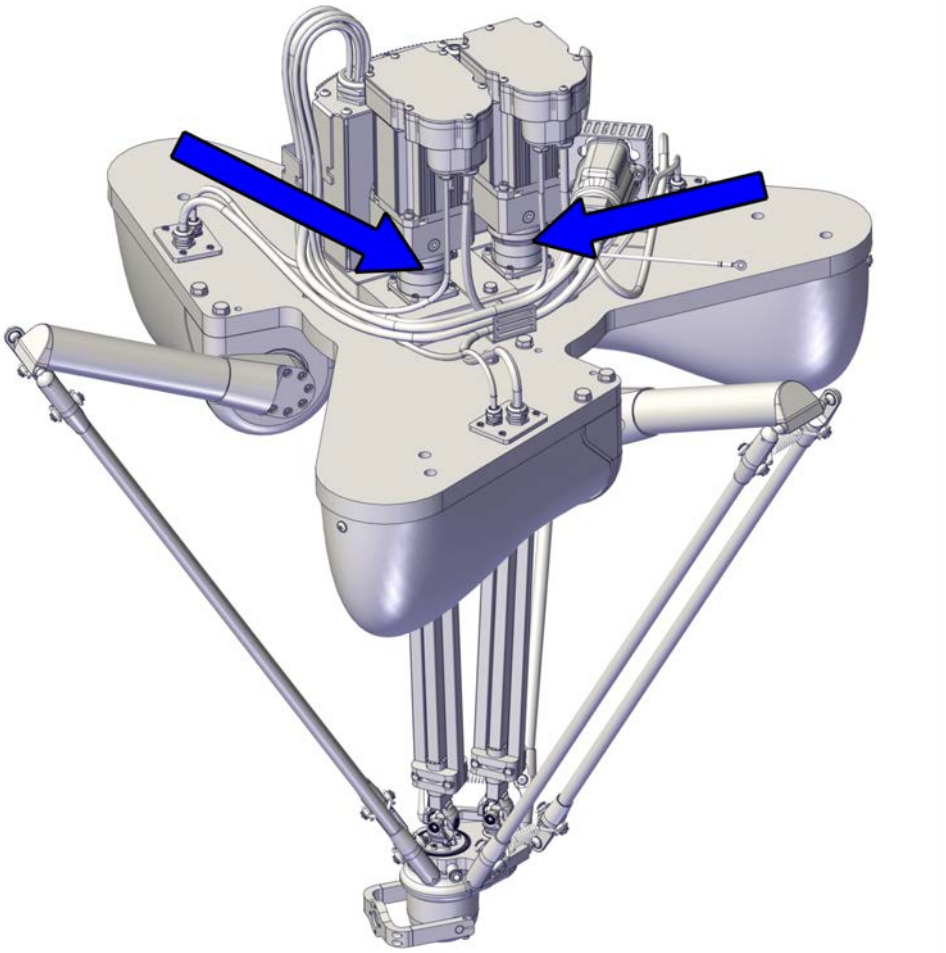
5.5.3 Replacing the axis-1, axis 2 and axis-3 gear unit
Continued

	Action	Note
3	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

5.5.4 Replacing the axis-4 and axis-5 gear unit

Location of the gear unit

The gear unit is located as shown in the figure.



xx2100001426

Required spare parts

Note

The spare part numbers that are listed in the table can be out of date. See the latest spare parts of the IRB 365 via myABB Business Portal, *www.abb.com/myABB*.

Spare part	Article number	Note
Gear unit	3HAC080023-001	

Continues on next page

5.5.4 Replacing the axis-4 and axis-5 gear unit
Continued

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 220*.

Required service parts

Consumable	Article number	Note
Locking liquid	-	Loctite 2400 (or equivalent Loctite 243)

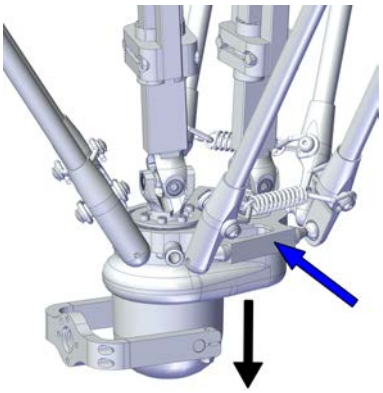
Removing the gear unit

Use these procedures to remove the gear unit.

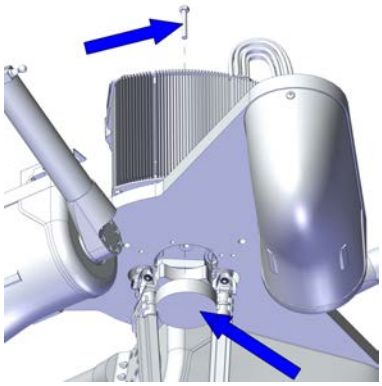
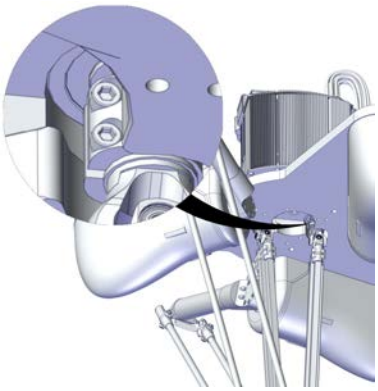
Preparations before removing the gear unit

	Action	Note
1	The robot does not need to be jogged into any specific position due to repair activity.	
2	**WARNING** Turn off all: • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
3	Remove any loads or tools attached to the tilt arm on the head.	

Loosen the upper mounting clamps for telescopic shaft

	Action	Note
1	**WARNING** Make sure that all supplies for hydraulic pressure and air pressure are turned off.	
2	Push the brake release button and press the delta plate with head downwards to extend the two telescopic shafts.	 xx2100000747

Continues on next page

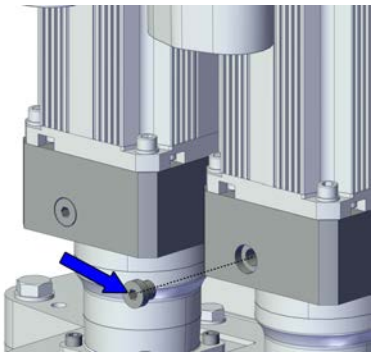
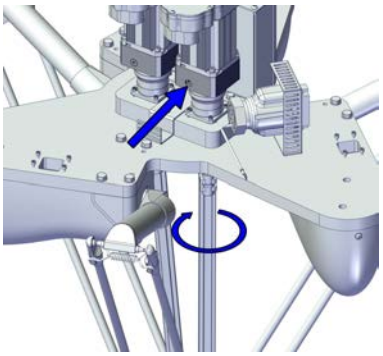
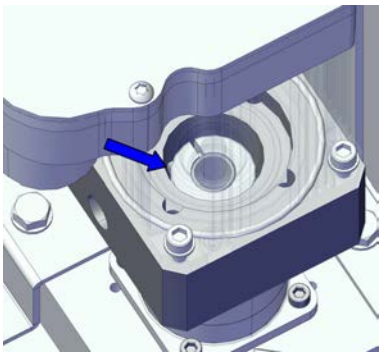
	Action	Note
3	Remove the center base cover.	 xx2100000732
4	Loosen the two attachment screws on the mounting clamp in the upper end of the telescopic shaft.	 xx2100000729

Removing the motor

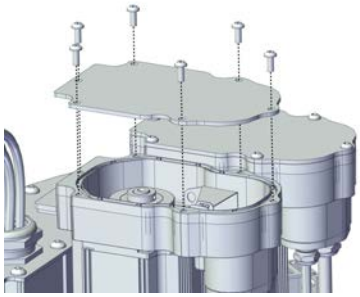
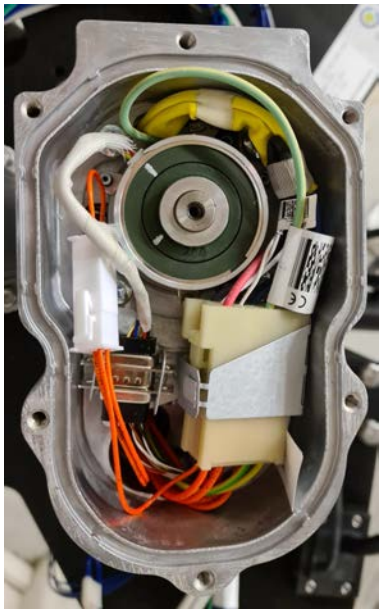
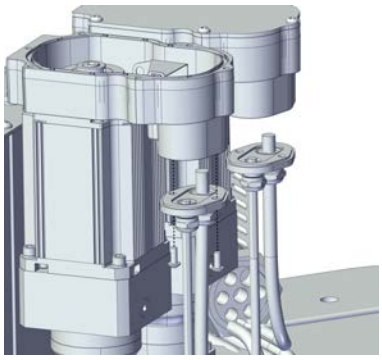
	Action	Note
1	**WARNING** Turn off all: • hydraulic pressure supply • air pressure supply to the robot, before entering the safeguarded space.	
2	**WARNING** To secure no accidental movement and engagement of drive power, set robot into manual mode and also engage the emergency stop on the FlexPendant.	

Continues on next page

5.5.4 Replacing the axis-4 and axis-5 gear unit
Continued

	Action	Note
3	Remove the protection plug in adapter plate.	 xx2100002706
4	Rotate telescopic arm to align the hex cap screw to the hole in adapter plate. Push the brake release button to release telescopic arm.	 xx2100002687
5	**WARNING** Turn off all: • electric power supply	
6	Loosen the hex cap screw for motor shaft.	 xx2100002688

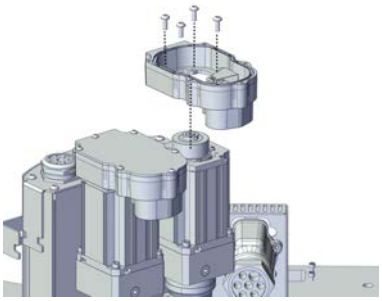
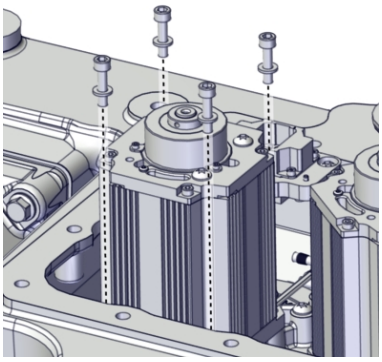
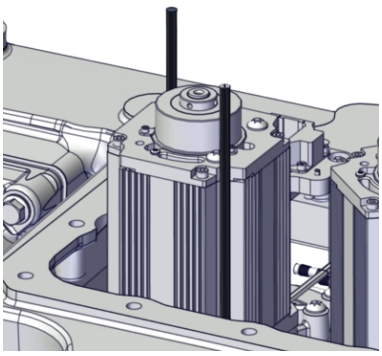
Continues on next page

	Action	Note
7	Remove M5-screws and motor cover.	 xx2100001418
8	Disconnect the white connector and the yellow connector on the motor top.	 xx2200000212
9	Remove the two screws and remove the cover with cable glands.	 xx2100001419

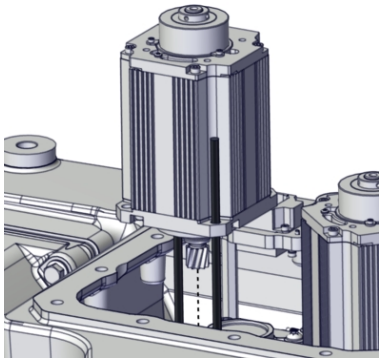
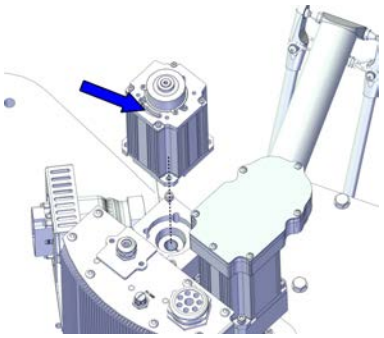
Continues on next page

5.5.4 Replacing the axis-4 and axis-5 gear unit

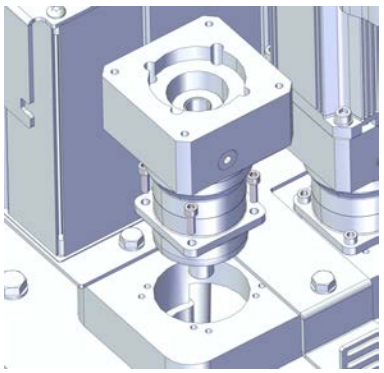
Continued

	Action	Note
10	Remove the M6-screws and the connection box. Clean the contact surface on connection box with isopropanol. Use a lint-free cloth.	 xx2100002700
11	Remove the four attachment screws with washers.	 xx2000001082
12	Fit guide pins in opposite holes.	 xx2000001084
13	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	

Continues on next page

	Action	Note
14	Use caution and lift the motor straight up to get the pinion parted from the gear.	 xx2000001083
15	Remove the motor.	 xx2100001422

Removing the gear unit

	Action	Note
1	Remove the gear unit.	 xx2100001424

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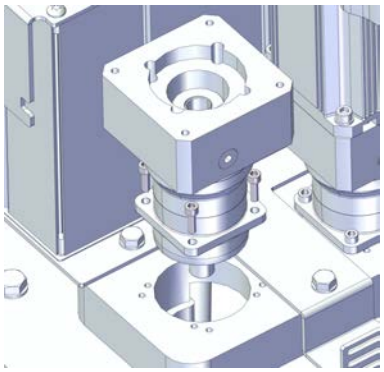
5.5.4 Replacing the axis-4 and axis-5 gear unit
Continued

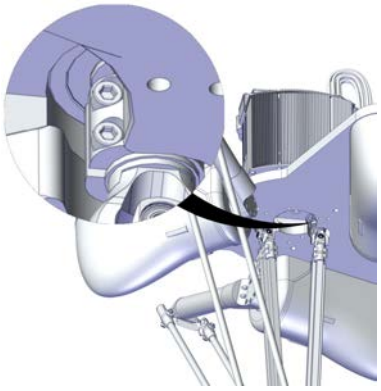
Refitting the gear unit

Use these procedures to refit the gear unit.

Refitting the gear unit

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	Add Loctite 243 to the four attachment screws.	
3	Refit the gear unit and tighten the four attachment screws.	Tightening torque: 7 Nm  xx2100001424

Refit the upper mounting clamps for telescopic shaft

	Action	Note
1	Refit the mounting clamp in the upper end of the telescopic shaft and tighten the two attachment screws.	Tightening torque: 10 Nm  xx2100000729

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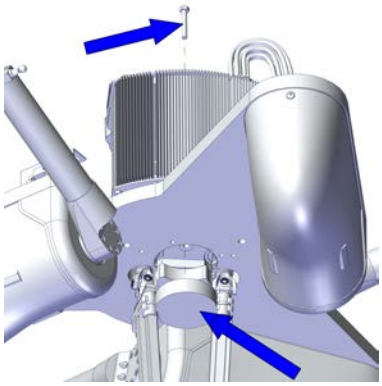
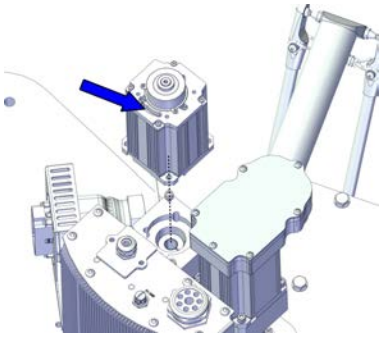
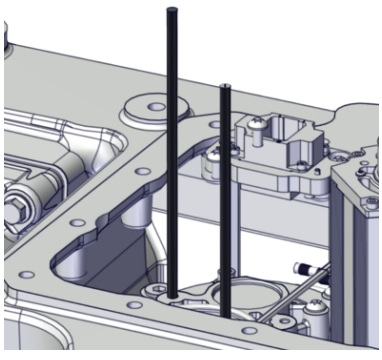
	Action	Note
2	Refit the center base cover.	 xx2100000732

Refitting the motor

	Action	Note
1	**DANGER** Make sure that all supplies for electrical power, hydraulic pressure, and air pressure are turned off.	
2	**Note** Clean the mating surface with isopropanol.	
3	Refit the motor. The recess on the top of the motor must be opposite oriented from protection plug at the adapter.	 xx2100001422
4	If not already fitted, fit two guide pins to the motor attachment holes.	 xx2000001088

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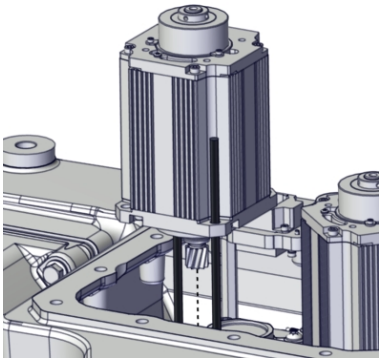
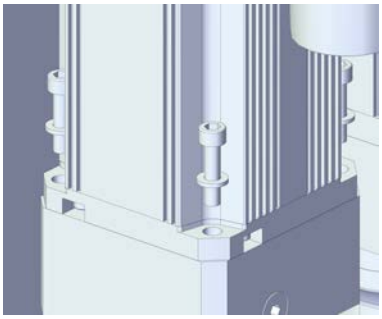
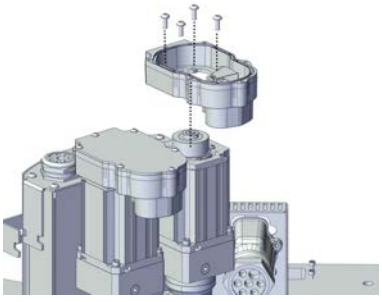
5.5.4 Replacing the axis-4 and axis-5 gear unit

Continued

	Action	Note
5	Lift the motor into the base. **Note** Clean the mating surface with isopropanol.	 xx2000001083
6	Add Loctite 243 to all screws. Secure the unit with attachment screws and washers.	Tightening torque: 7 Nm  xx2100001421
7	Clean with isopropanol.	
8	Add transclear into the groove for the o-ring.	
9	Refit connection box and the M6-screws.	Tightening torque: 12 Nm  xx2100002700

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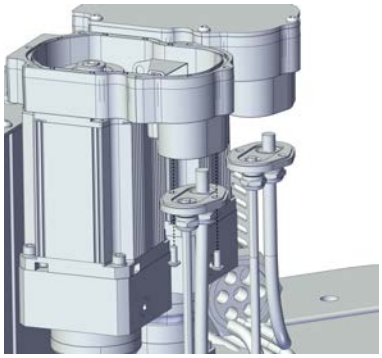
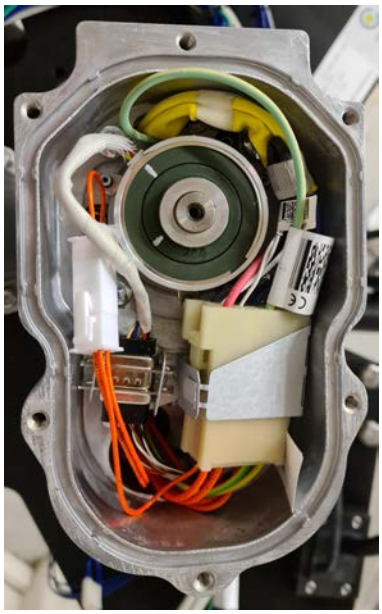
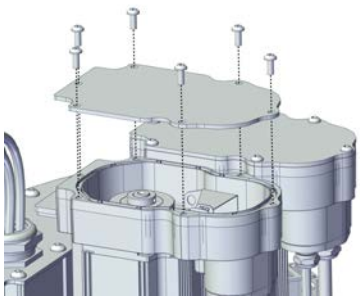
	Action	Note
10	Refit the cover with cable glands and the two M5-screws.	3.5 Nm  xx2100001419
11	Connect the white connector and the yellow connector. The cables must not interfere movement parts.	 xx2200000212
12	Refit the motor cover and M5-screws.	Tightening torque: 6 Nm  xx2100001418
13	**WARNING** Turn on all: • electric power supply	

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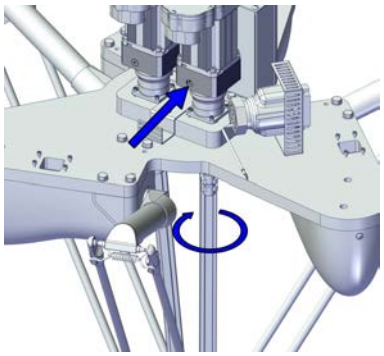
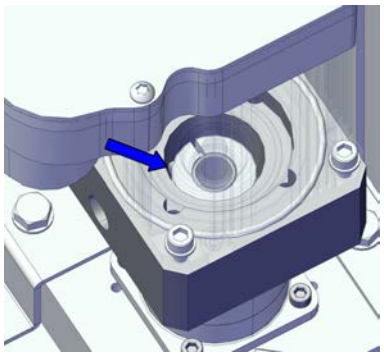
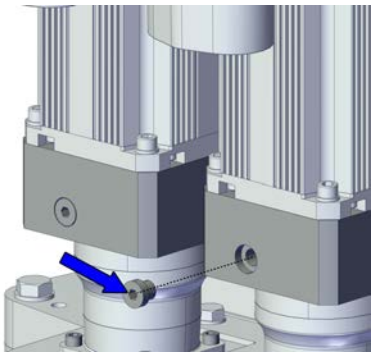
5.5.4 Replacing the axis-4 and axis-5 gear unit

Continued

	Action	Note
14	Rotate telescopic arm to align the hex cap screw to the hole in adapter plate. If needed push the brake release button to release telescopic arm.	 xx2100002687
15	Refit the hex cap screw and tighten the mounting clamp for motor shaft. See tightening torque on the mounting clamp.	Tightening torque: 9.5 Nm  xx2100002688
16	Refit the protection plug in adapter plate.	 xx2100002706

Concluding procedure

	Action	Note
1	**CAUTION** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used.	
2	Calibrate the robot.	See *Calibration information on page 191*.

Continues on next page

	Action	Note
3	 **DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

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6 Calibration information

6.1 When to calibrate

When to calibrate

The system must be calibrated if any of the following situations occur.

The resolver values are changed

If resolver values are changed, the robot must be re-calibrated using the calibration methods supplied by ABB. Calibrate the robot carefully with standard calibration, according to information in this manual.

The resolver values will change when parts affecting the calibration position are replaced on the robot, for example motors or parts of the transmission.

The revolution counter memory is lost

If the revolution counter memory is lost, the counters must be updated. See *Updating revolution counters on OmniCore robots on page 202*. This will occur when:

- The battery is discharged
- A resolver error occurs
- The signal between a resolver and measurement board is interrupted
- A robot axis is moved with the control system disconnected

The revolution counters must also be updated after the robot and controller are connected at the first installation.

The robot is rebuilt

If the robot is rebuilt, for example, after a crash or when the reachability of a robot is changed, it needs to be re-calibrated for new resolver values.

6.2 Introduction and calibration terminology

Calibration information

This chapter includes general information about the recommended calibration methods and also the detailed procedures for updating the revolution counters, checking the calibration position etc.

Calibration terminology

Term	Definition
Calibration method	A collective term for several methods that might be available for calibrating the ABB robot. Each method contains calibration routines.
Synchronization position	Known position of the complete robot where the angle of each axis can be checked against visual synchronization marks.
Calibration position	Known position of the complete robot that is used for calibration of the robot.
Standard calibration	A generic term for all calibration methods that aim to move the robot to calibration position.
Fine calibration	A calibration routine that generates a new zero position of the robot.
Reference calibration	A calibration routine that in the first step generates a reference to current zero position of the robot. The same calibration routine can later on be used to recalibrate the robot back to the same position as when the reference was stored. This routine is more flexible compared to fine calibration and is used when tools and process equipment are installed. Requires that a reference is created before being used for recalibrating the robot. Requires that the robot is dressed with the same tools and process equipment during calibration as during creation of the reference values.
Update revolution counter	A calibration routine to make a rough calibration of each manipulator axis.
Synchronization mark	Visual marks on the robot axes. When marks are aligned, the robot is in synchronization position.

6.3 Calibration method

Overview

This section specifies the different types of calibration and the calibration methods that are supplied by ABB.

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	Standard calibration is performed if resolver values are changed or the robot is rebuilt (see *When to calibrate on page 191*). The robot is positioned at calibration position, that is when the positions of the axes 1-3 (angles) are set to parameter values found in *Calibration Position*, see type *Arm*, topic *Motion* in *Technical reference manual - System parameters*. Standard calibration data is found on the SMB (serial measurement board) in the robot. For robots with RobotWare 5.04 or older, the calibration data is delivered in a file, calib.cfg, supplied with the robot at delivery. The file identifies the correct resolver/motor position corresponding to the robot home position.	Calibration by hand with activated brake release, using the calibration marks.
Factory reset	A factory reset (calibration with a calibration tool) can be performed after a gearbox or an upper arm has been replaced to ensure enhanced robot arm accuracy than when performing standard calibration. Factory reset alters the robot's unique production settings for axis 1-3. To perform tool calibration, the lower arms must first be removed from the robot. The upper arms must then be positioned horizontally so that the calibration tool can be fitted mounted. Making a factory reset with the calibration tool requires specific calibration equipment and software, and is performed by ABB. Please contact ABB. The parameter *Calibration Position* (cal_position) is set at the ABB factory, and is a robot specific parameter. For more information about parameter *Calibration Position*, see topic *Motion*, type *Arm* in *Technical reference manual - System parameters*.	Tool calibration

Calibration methods

The calibration method for the IRB 365 is different from other robots, and normal calibration methods are not applicable.

Tool calibration

A factory reset using tool calibration requires specific calibration equipment and is performed by ABB. Please contact ABB.

Continues on next page

Tool calibration is measuring each contact point for axis 1-3 and modifies cal_position. The tool calibration method gives a better nominal kinematics and the modified cal_positions will help to get back to the same points when calibrating with Standard calibration.

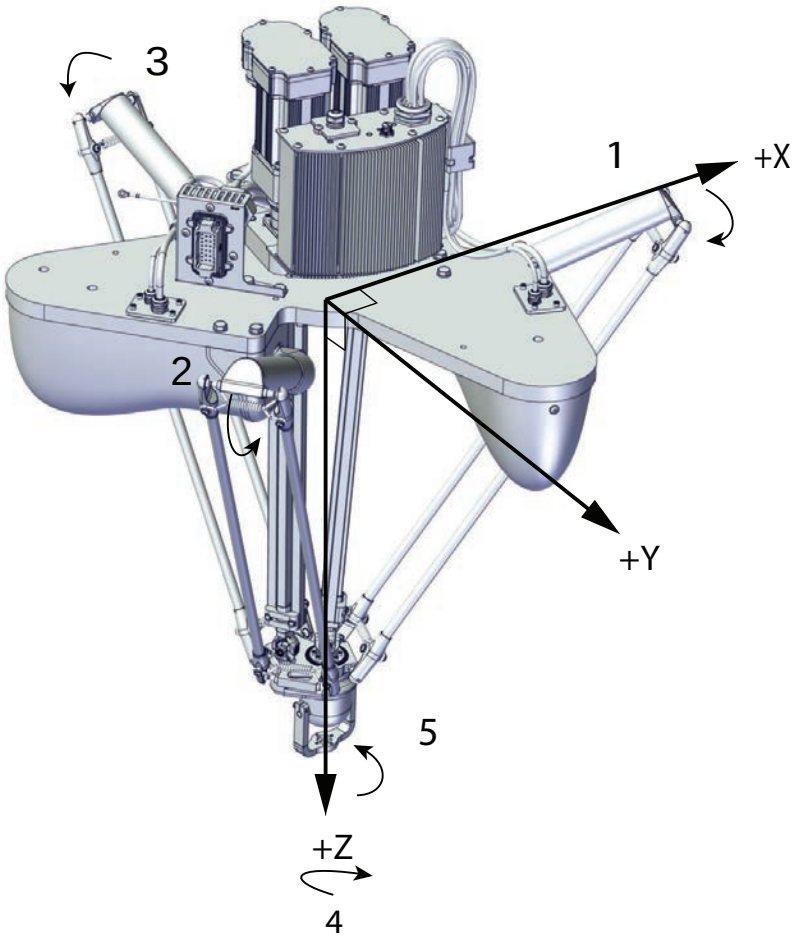
6.4 Calibration movement directions for all axes

Overview

When calibrating, the axis must consistently be run towards the calibration position in the same direction in order to avoid position errors caused by backlash in gears and so on. Positive directions are shown in the graphic below.

Calibration service routines will handle the calibration movements automatically and these might be different from the positive directions shown below.

Manual movement directions



xx2200000237

6.5 Calibrating axis 1-3

General

This section is valid for IRB 365 all models. It describes how to perform the actual fine calibration of axis 1-3.

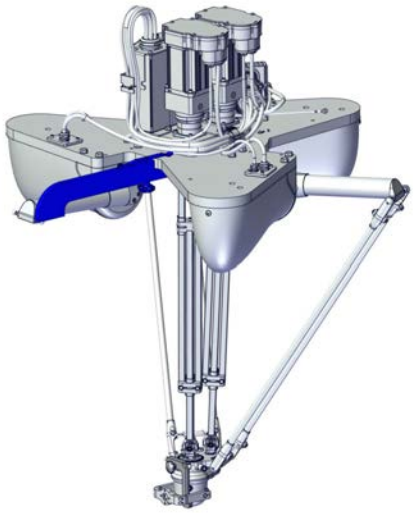
If the robot needs to have a factory reset instead, contact ABB.

Note

Calibration should be performed by specially trained personnel.

Illustration

The figure shows the calibration tool fitted to the robot.



xx2100002603

Required equipment

Equipment	Article number	Note
Calibration tool	**IRB 365-1.5/800** and **IRB 365 1.5/1100**: 3HAC081390-001 **IRB 365-1.5/1300**: 3HAC084354-001	Used when calibrating axis 1-3

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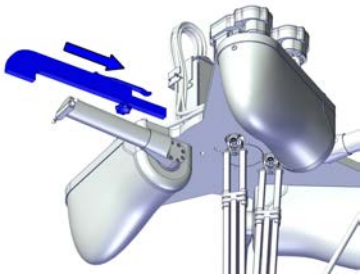
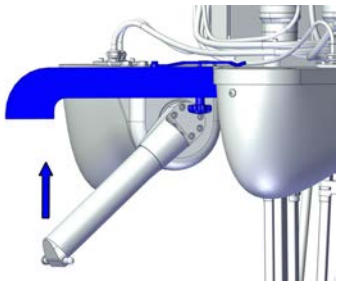
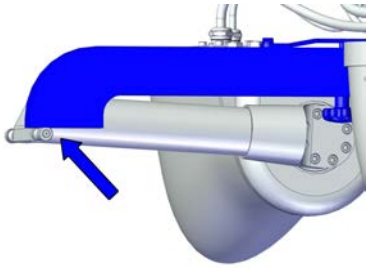
Calibrating axes 1-3

	Action	Note
1	Slide the calibration tool onto the base plate and tighten the star knob until the calibration tool is fixed.	 xx2100002598
2	Remove the lower arm, release the brake, and move the upper arm towards the calibration tool.	 xx2100002599
3	Lock the brake when the ball joint makes contact with calibration tool.	 xx2100002600
4	Perform a fine calibration of the upper arm.	See *Fine calibration procedure on FlexPendant on page 200*.
5	Remove the calibration tool when manipulator arm is in zero position.	
6	Repeat these steps for all three upper arms.	
7	Verify the application in the operating mode manual reduced speed, before changing mode to automatic and initiating automatic operation.	See *Safety on page 15*.
8	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

6.6 Calibrating axis 4-5

General

This section is valid for IRB 365 all models. It describes how to perform the actual fine calibration of axis 4-5.

If the robot needs to have a factory reset instead, contact ABB.

Note

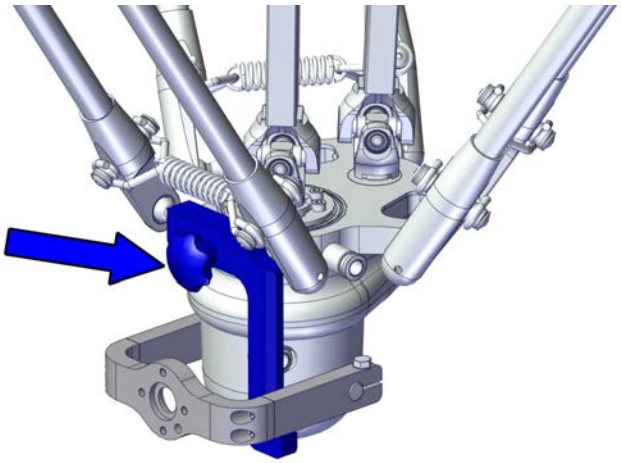
Calibration should be performed by specially trained personnel.

Note

When calibrating axis 4 and 5, both axis 4 and 5 are calibrated simultaneously.

Illustration

The figure shows the calibration tool fitted to the robot.



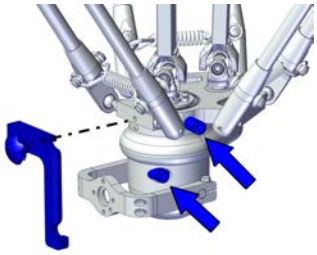
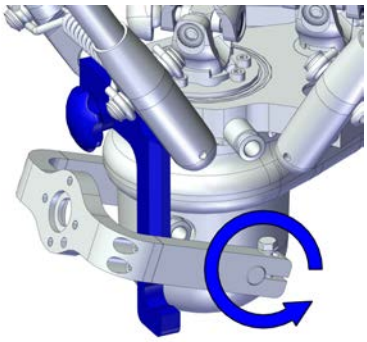
xx2200000017

Required equipment

Equipment	Article number	Note
Calibration tool	3HAC081391-001	Used when calibrating axis 4-5

Continues on next page

Calibrating axes 4-5

	Action	Note
1	Slide the calibration tool onto the delta plate and tighten the star knob until the calibration tool is locked. Align the two pneumatic couplings in same direction.	 xx2100002601
2	Rotate tilt arm until it makes contact with calibration tool.	 xx2100002602
3	Perform a fine calibration of the tilt arm.	See *Fine calibration procedure on FlexPendant on page 200*.
4	Remove the calibration tool when manipulator tilt arm is in zero position.	
5	Verify the application in the operating mode manual reduced speed, before changing mode to automatic and initiating automatic operation.	See *Safety on page 15*.
6	**DANGER** Make sure all safety requirements are met when performing the first test run. See *Test run after installation, maintenance, or repair on page 70*.	

6.7 Fine calibration procedure on FlexPendant

Overview

This section describes how to use the FlexPendant when performing a fine calibration of the robot.

The method of fitting the calibration tools to each axis is described in the calibration instruction for the axis. See the product manual for the robot.

Performing the fine calibration procedure when connecting to OmniCore controller

Note

If protective gloves are used, these must be compatible with touchscreens when using the FlexPendant.

Note

If the calibration status is **Not calibrated**, the fine calibration must be performed before running the axis calibration procedure.

WARNING

Before starting the calibration procedure, you must jog each axis and bring the robot to synchronization position and make sure that all the notches are matched.

	Action	Note
1	On the start screen, tap **Calibrate**.	
2	Select **Calibration** from the menu. The **Mechanical Units** page displays a list of available mechanical units. **Note** This step is required only if you are not already in the **Mechanical Unit** page when you open **Calibrate**. **Note** The **Mechanical Unit** page is displayed only if there are more than one mechanical unit available. Otherwise, the calibration summary page for the available mechanical unit is displayed.	
3	Select the unit that needs to be calibrated from the **Mechanical Unit** list. The calibration summary for the selected mechanical unit is displayed.	
4	On the right pane tap **Calibration Methods**.	
5	Tap **Calibration Parameters**. The calibration parameters are displayed.	

Continues on next page

	Action	Note
6	Tap **Fine Calibration**. A dialog box is displayed, urging you to use external equipment to perform the actual calibration. Make sure all necessary calibration equipment is fitted for the axis to be calibrated. A warning that performing fine calibration can change programmed robot positions is also displayed: • Tap **Yes** to proceed. • Tap **No** to cancel.	
7	Select the check-box for the current axis/axes to be calibrated.	
8	Tap **Calibrate**. A dialog box is displayed, warning that calibration of the selected axes will be changed, which cannot be undone: • Tap **Calibrate** to proceed. • Tap **Cancel** to cancel. Tapping **Calibrate** results in briefly displaying a dialog box, announcing that the calibration process has started. The axis is calibrated and the system returns to the list of available mechanical units.	
9	Tap **OK**. The fine calibration process is complete.	

6.8 Updating revolution counters on OmniCore robots

Introduction

This section describes how to do a rough calibration of each manipulator axis by updating the revolution counter for each axis, using the FlexPendant.

Step 2 - Updating the revolution counter with the FlexPendant

Use this procedure to update the revolution counter with the FlexPendant (OmniCore).

	Action
1	On the start screen, tap **Calibrate**.
2	Select **Calibration** from the menu. The **Mechanical Units** page displays a list of available mechanical units. **Note** This step is required only if you are not already in the **Mechanical Unit** page when you open **Calibrate**. **Note** The **Mechanical Unit** page is displayed only if there are more than one mechanical unit available. Otherwise, the calibration summary page for the available mechanical unit is displayed.
3	Select the mechanical unit for which revolution counter need to be updated.
4	The calibration summary page for the selected mechanical unit is displayed. Calibration method used at factory for each axis is shown, as well as calibration method used during last field calibration.
5	Tap **Calibration Methods** on the right pane. The calibration options are displayed.
6	Tap **Revolution Counters**.
7	In the **Selection** column select the axes for which revolution counters need to be updated.
8	Tap **Update**. A dialog box is displayed, warning that the updating operation cannot be undone: • Tap **Update** to proceed with updating the revolution counters. • Tap **Cancel** to cancel updating the revolution counters. Tapping **Update** and a confirmation window is displayed.
9	Tap **OK**. The revolution counter for the selected axes is updated.
10	**CAUTION** If a revolution counter is incorrectly updated, it will cause incorrect manipulator positioning, which in turn may cause damage or injury!

7 Troubleshooting

7.1 Introduction to troubleshooting

Introduction

The product manual and the circuit diagram contains information that can be good when troubleshooting.

For OmniCore, all event logs from the software can be seen on the FlexPendant, or in *Technical reference manual - Event logs for RobotWare 7*.

Make sure to read through the section *Safety on page 15* before starting.

Troubleshooting strategies

1. Isolate the fault to pinpoint the cause of the problem from consequential problems.
2. Divide the fault chain in two.
3. Check communication parameters and cables.
4. Check that the software version is compatible with the hardware.

Work systematically

1. Take a look around to make sure that all screws, connectors, and cables are secured, and that the robot and other parts are clean, not damaged, and correctly fitted.
2. Replace one thing at a time.
3. Do not replace units randomly.
4. Make sure that there are no loose screws, turnings, or other unexpected parts remaining after work has been performed.
5. When the work is completed, verify that the safety functions are working as intended.

Keep a track of history

- Make a historical fault log to keep track of problems over time.
- Consult those working with the robot when the problem occurred.

Basic scenarios

What to look for during troubleshooting depends on when the fault occurred. Was the robot recently installed or was it recently repaired? The following table gives hints on what to look for in specific situations.

The robot has recently been installed	Check: • the configuration files • connectors • options and their configuration • changes in the robot working space/movements.

Continues on next page

7.1 Introduction to troubleshooting

Continued

The robot has recently been repaired	Check: • all connections to the replaced part • power supplies • that the correct part has been fitted • the last repair documents.
The robot recently had a software upgrade	Check: • software versions • compatibilities between hardware and software • options and their configuration
The robot has recently been moved from one site to another (an already working robot)	Check: • connections • software versions

7.2 Mechanical noise or dissonance

Description

Mechanical noise or dissonance that has not been observed before can indicate problems in bearings, motors, gearboxes, or similar. Be observant of changes over time.

A faulty bearing often emits scraping, grinding, or clicking noises shortly before failing.

Consequences

Failing bearings cause the path accuracy to become inconsistent, and in severe cases, the joint can seize completely.

Possible causes

The symptom can be caused by:

- Worn bearings.
- Contaminations have entered the bearing grooves.
- Loss of lubrication in bearings.
- Loose heat sinks, fans, or metal parts.

If the noise is emitted from a gearbox, the following can also apply:

- Overheating.

Recommended actions

The following actions are recommended:

	Action	Information
1	**CAUTION** Allow hot parts to cool down.	
2	Verify that the service is done according to the maintenance schedule.	
3	If a bearing is emitting the noise, determine which one and make sure that it has sufficient lubrication.	
4	If possible, disassemble the joint and measure the clearance.	
5	Bearings inside motors are not to be replaced individually, but the complete motor is replaced.	
6	Make sure the bearings are fitted correctly.	
7	Tighten the screws if a heat sink, fan, or metal sheet is loose.	

7.3 Manipulator collapses on power down

Description

The manipulator is able to work correctly while Motors ON is active, but when Motors OFF is active, one or more axes drops or collapses under its own weight.

The holding brakes (normally one in each motor), is not able to hold the weight of the manipulator arm.

Consequences

For a heavy robot, the collapse can cause severe injury to personnel working in the area or severe damage to the robot and/or surrounding equipment.

For a small robot, the collapse can cause injury to personnel working close to the robot or damage to the robot and/or surrounding equipment.

Possible causes

The symptom can be caused by:

- Faulty brake.
- Faulty power supply to the brake.

Recommended actions

The following actions are recommended:

	Action	Information
1	Determine which motor(s) causes the robot to collapse.	
2	Check the brake power supply to the collapsing motor during the Motors OFF state.	See the circuit diagram.
3	Remove the resolver or resolver cover of the motor to see if there are any signs of oil leaks.	If found faulty, the motor must be replaced as a complete unit.
4	Remove the motor from the gearbox to inspect it from the drive side.	If found faulty, the motor must be replaced as a complete unit.

7.4 Robot is jammed

Description

Take extra precaution if robot is jammed. The mechanical arm or external/auxillary equipment causing the jam may contain stored potential energy that can result in an unexpected motion or collapse of the manipulator arms.

Consequences

The unexpected motion or collapse can cause injury to personnel working close to the

robot or damage to the robot and/or surrounding equipment.

Possible causes

Symptom may be caused by:

- Robot colliding with external equipment in the programmed path e.g a conveyor belt.

Recommended actions

The following actions are recommended:

	Action	Information
1	Attempt to jog the robot out of stuck position.	
2	Attempt to release the robot from stuck position with brake release.	
3	Attempt to reverse or disengage the mechanism in which the manipulator is stuck.	
4	If step 1-3 has been performed and the manipulator is still stuck, apply other risk reduction to avoid hazardous release of stored energy.	

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8 Decommissioning

8.1 Introduction to decommissioning

Introduction

This section contains information to consider when taking a product, robot or controller, out of operation.

It deals with how to handle potentially dangerous components and potentially hazardous materials.

> **Note**
>
> The decommissioning process shall be preceded by a risk assessment.

Disposal of materials used in the robot

All used grease/oils and dead batteries **must** be disposed of in accordance with the current legislation of the country in which the robot and the control unit are installed.

If the robot or the control unit is partially or completely disposed of, the various parts **must** be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts **must** also be disposed of in accordance with the current legislation of the country in which the robot and control unit are installed.

See also *Environmental information on page 210*.

Transportation

Prepare the robot or parts before transport, this to avoid hazards.

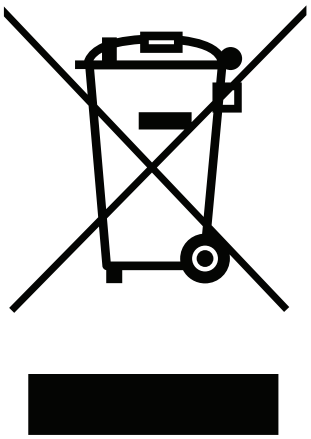
8.2 Environmental information

Introduction

ABB robots contain components in different materials. During decommissioning, all materials should be dismantled, recycled, or reused responsibly, according to the relevant laws and industrial standards. Robots or parts that can be reused or upcycled helps to reduce the usage of natural resources.

Symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



xx1800000058

Materials used in the product

The table specifies some of the materials in the product and their respective use throughout the product.

Dispose components properly according to local regulations to prevent health or environmental hazards.

Material	Example application
Aluminium	Base structure, upper arms, tilt arm, gear housing, motors, connection box, cable harness
Batteries, Lithium	Serial measurement board
Cast iron/nodular iron	
Copper	Cables, motor wiring, pins, sockets
Magnesium	Wrist casting, upper arm, back cover, tool flange, etc
Neodymium	Brakes, motors
Oil, grease	Gearboxes
Plastic/rubber	Cable, jackets, clamps, O-rings, plugs, clothes, sealings and gasgets

Continues on next page

Material	Example application
Steel	Gears, pinions, bearings, shafts, brackets, motors bolts, washers, SMB/BU covers, spacers, locks, sockets

Oil and grease

Where possible, arrange for oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains, or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills can form a film on water surfaces causing damage to organisms. Oxygen transfer could also be impaired.
- Spillage can penetrate the soil causing ground water contamination.

8.3 Scrapping of robot

Note

The decommissioning process shall be preceded by a risk assessment.

Important when scrapping the robot

DANGER

The risk assessment should consider hazards arising in the decommissioning, such as, but not limited to:

- Always remove all batteries. If a battery is exposed to heat, for example from a blow torch, it will explode.
- Always remove all oil/grease in gearboxes. If exposed to heat, for example from a blow torch, the oil/grease will catch fire.
- When motors are removed from the robot, the robot will collapse if it is not properly supported before the motor is removed.
- A used robot does not have the same performance as on delivery. Springs, brakes, bearings, and other parts might be worn or broken.

9 Reference information

9.1 Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

9.2 Applicable standards

General

The product is compliant with ISO 10218-1:2011, *Robots for industrial environments - Safety requirements - Part 1 Robots*, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

Other standards used in design

Standard	Description
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1

Region specific standards and regulations

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-03	Industrial robots and robot Systems - General safety requirements
EN ISO 10218-1	Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots

9.3 Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

9.4 Screw joints

General

This section describes how to tighten the various types of screw joints on ABB robots.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. It is recommended by ABB for M6-M20 screw joints. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

Generally, screws are lubricated with *Gleitmo 603* mixed with *Geomet 500* or *Geomet 702* in proportion 1:3. *Geomet* thickness varies according to screw dimensions, refer to the following.

Dimension	Lubricant	Geomet thickness
M6-M20 (any length except M20x60)	*Gleitmo 603 + Geomet 500*	3-5 µm
M6-M20 (any length except M20x60)	*Gleitmo 603 + Geomet 720*	3-5 µm
M20x60	*Gleitmo 603 + Geomet 500*	8-12 µm
M20x60	*Gleitmo 603 + Geomet 720*	6-10 µm

Screws lubricated in other ways

Screws lubricated with Molykote 1000 or Molykote P1900 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

1. Apply lubricant to the screw thread.
2. Apply lubricant between the plain washer and screw head.
3. Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench *if* this is done by trained and qualified personnel.

Continues on next page

Lubricant	Article number
Molykote 1000 (molybdenum disulphide grease)	3HAC042472-001
Molykote P1900 (molybdenum disulphide grease)	3HAC070875-001

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand,* and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

Tightening torque for oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Tightening torque for oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670

Continues on next page

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M24	680	960	1150

Tightening torque for lubricated screws (Molykote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M5		8
M6		14
M8	28	35
M10	55	70
M12	96	120
M16	235	300
M20	460	550
M24	790	950

i Lubricated with Molycote 1000, Gleitmo 603 or equivalent

9.5 Weight specifications

Definition

In installation, repair, and maintenance procedures, weights of the components handled are sometimes specified. All components exceeding 22 kg (50 lbs) are highlighted in this way.

To avoid injury, ABB recommends the use of a lifting accessory when handling components with a weight exceeding 22 kg. A wide range of lifting accessories and devices are available for each manipulator model.

Example

Following is an example of a weight specification in a procedure:

	Action	Note
	CAUTION The arm weighs 25 kg. All lifting accessories used must be sized accordingly.	

9.6 Standard toolkit

General

All service (repairs, maintenance, and installation) procedures contains lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the following table.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

Contents, standard toolkit

Qty	Tool	Rem.
1	Ring-open-end spanner 8-19 mm	
1	Socket head cap 2.5-17 mm	
1	Torx socket no: 20-60	
1	Box spanner set	
1	Torque wrench 10-100 Nm	
1	Torque wrench 75-400 Nm	
1	Ratchet head for torque wrench 1/2	
2	Hexagon-headed screw M10x100	
1	Hexagon-headed screw M16x90	
1	Hex bit socket head cap no. 14 socket 40 mm L=100 mm	
1	Hex bit socket head cap no. 14 socket 40 mm L=20 mm	To be shortened to 12 mm
1	Hex bit socket head cap no. 6 socket 40 mm L=145 mm	
1	Hex bit socket head cap no. 6 socket 40mm bit L=220 mm	
1	Plastic mallet	

9.7 Special tools

General

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in the section *Standard toolkit on page 220*, and of special tools, listed directly in the instructions and also gathered in this section.

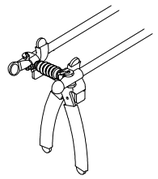
Special tools

Note

If the replacing procedure is not listed in the table below, only standard tools are needed for the procedure.

Continues on next page

9.7 Special tools

Tools and equipment with spare part number: (These tools can be ordered from ABB)				Parallel arms
Removal tools				
Pliers for parallel arms	3HAC6194-1	Used to push the parallel arms apart.	 xx0700000555	1

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9.8 Lifting accessories and lifting instructions

General

Many repair and maintenance activities require different pieces of lifting accessories, which are specified in each procedure.

The use of each piece of lifting accessories is *not* detailed in the activity procedure, but in the instruction delivered with each piece of lifting accessories.

The instructions delivered with the lifting accessories should be stored for later reference.

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10 Spare part lists

10.1 Spare part lists and illustrations

Location

Spare parts and exploded views are not included in the manual but delivered as a separate document for registered users on myABB Business Portal, *www.abb.com/myABB*.

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

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